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NATIONAL DAM SAFETY PROGRAM. CHEROKEE LAKE DAM (NJ00785). PASSA--ETC(U)
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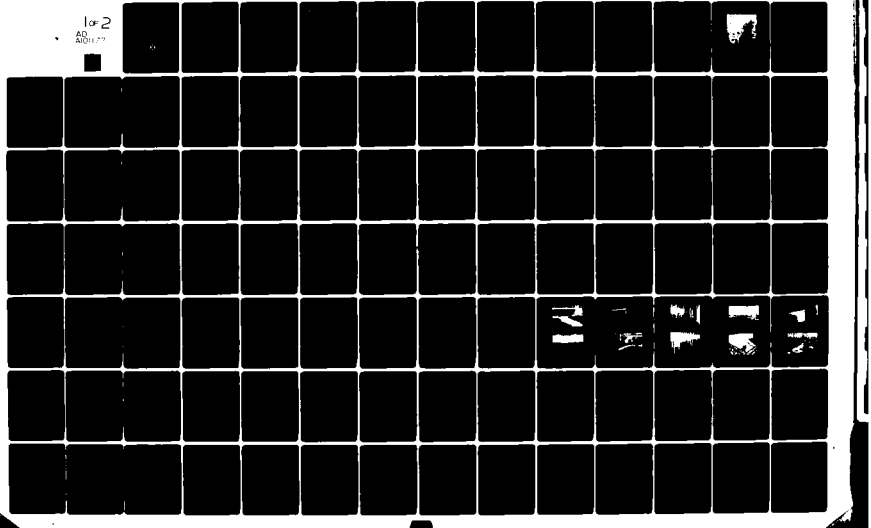

PASSAIC RIVER BASIN
INDIA BROOK, MORRIS COUNTY
NEW JERSEY

CHEROKEE LAKE DAM
NJ 00785

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

DACW61-79-C-0011

DEPARTMENT OF THE ARMY
Philadelphia District
Corps of Engineers
Philadelphia, Pennsylvania

REPT. NO.: DAEN/NAP-53842/NJ00785-81/05

MAY 1981

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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7. AUTHOR(s) McDermott, Richard J., PE Gribbin, John E. PE	8. CONTRACT OR GRANT NUMBER(s) DACW61-79-C-0011
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Channel
Seepage

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE—2D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

(1)

IN REPLY REFER TO
NAPEN-N

15 JUN 1981

Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, New Jersey 08621

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Cherokee Lake Dam in Morris County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, Cherokee Lake Dam, initially listed as a high hazard potential structure, but reduced to a significant hazard potential structure as a result of this inspection is judged to be in fair overall condition. The dam's spillway is considered inadequate because a flow equivalent to 57 percent of the One Hundred Year Flood would cause the dam to be overtopped. To ensure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures and studies within six months from the date of approval of this report. Within three months of the consultant's findings remedial measures to ensure spillway adequacy should be initiated.

b. Within six months from the date of approval of this report the following remedial actions should be initiated:

(1) All trees and adverse vegetation on the embankment should be removed and the surfaces properly stabilized.

(2) The outlet works should be investigated with respect to operational adequacy and then restored to proper operational condition.

(3) The spillway structure should be thoroughly inspected with the lake drawn down. Spalled and deteriorated portions of the concrete should be repaired.

(4) The embankment should be regraded to bring the low portion of the crest up to the elevation of the remainder of the embankment.

(5) The downstream channel in the vicinity of the dam should be adequately protected against erosion.

(6) The diversion channel should be adequately protected against erosion; especially along the toe of the dam to prevent undermining of the embankment.

(7) Debris in the downstream channel in the vicinity of the dam should be removed.

(8) The two areas of seepage observed at the toe of the dam should be monitored in order to detect any changes in their condition.

c. The owner should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam within one year from the date of approval of this report.

d. An emergency action plan should be developed which outlines actions to be taken by the owner to minimize the downstream effects of an emergency at the dam within six months from the date of approval of this report.

A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congressman Courter of the Thirteenth District. Under the provision of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

NAPEN-N

Honorable Brendan T. Byrne

An important aspect of the Dam Inspection Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

Sincerely,

JAMES G. TON
Colonel, Corps of Engineers
Commander and District Engineer

1 Incl
As stated

Copies furnished:
Mr. Dirk C. Hofman, P.E., Deputy Director
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

Mr. John O'Dowd, Acting Chief
Bureau of Flood Plain Regulation
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

CHEROKEE LAKE DAM (NJ00785)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 24 December 1980 by Storch Engineers, under contract to the State of New Jersey. The State, under agreement with the U.S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

Cherokee Lake Dam, initially listed as a high hazard potential structure, but reduced to a significant hazard potential structure as a result of this inspection is judged to be in fair overall condition. The dam's spillway is considered inadequate because a flow equivalent to 57 percent of the One Hundred Year Flood would cause the dam to be overtopped. To ensure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures and studies within six months from the date of approval of this report. Within three months of the consultant's findings remedial measures to ensure spillway adequacy should be initiated.

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(1) All trees and adverse vegetation on the embankment should be removed and the surfaces properly stabilized.

(2) The outlet works should be investigated with respect to operational adequacy and then restored to proper operational condition.

(3) The spillway structure should be thoroughly inspected with the lake drawn down. Spalled and deteriorated portions of the concrete should be repaired.

(4) The embankment should be regraded to bring the low portion of the crest up to the elevation of the remainder of the embankment.

(5) The downstream channel in the vicinity of the dam should be adequately protected against erosion.

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(8) The two areas of seepage observed at the toe of the dam should be monitored in order to detect any changes in their condition.

c. The owner should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam within one year from the date of approval of this report.

d. An emergency action plan should be developed which outlines actions to be taken by the owner to minimize the downstream effects of an emergency at the dam within six months from the date of approval of this report.

APPROVED: James G. Ton

JAMES G. TON
Colonel, Corps of Engineers
Commander and District Engineer

DATE: 15 Jan 1981

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Cherokee Lake Dam, NJ00785
State Located:	New Jersey
Located:	Morris
Drainage Basin:	Raritan River
Stream:	India Brook
Date of Inspection:	December 24,1980

Assessment of General Condition of Dam

Based on available records, past operational performance, visual inspection and Phase I engineering analysis, Cherokee Lake Dam is assessed as being in overall fair condition.

Based on investigations of the downstream flood plain made in connection with this report, it is recommended that the hazard potential classification be downgraded from high to significant hazard.

Hydraulic and hydrologic analyses indicate that the spillway is inadequate. Discharge from the spillway is not sufficient to pass the designated spillway design floor (100-year storm) without an overtopping of the dam. The spillway is capable of passing approximately 56 percent of the SDF. Therefore, the owner should engage a professional engineer experienced in the design and construction of dams in the near future to perform more accurate hydraulic and hydrologic analyses relating to the spillway capacity. Based on the findings of the analyses, the need for and type of remedial measures should be determined and then implemented.

The owner should, in the near future, develop an emergency action plan together with an effective warning system outling actions to be taken by the operator to minimize downstream effect of an emergency at the dam.

Two areas of seepage were observed at the toe of dam. Arrangements should be made in the near future to monitor the seepage in order to detect any changes in its condition. The monitoring should be performed by a professional engineer experienced in the design and construction of dams.

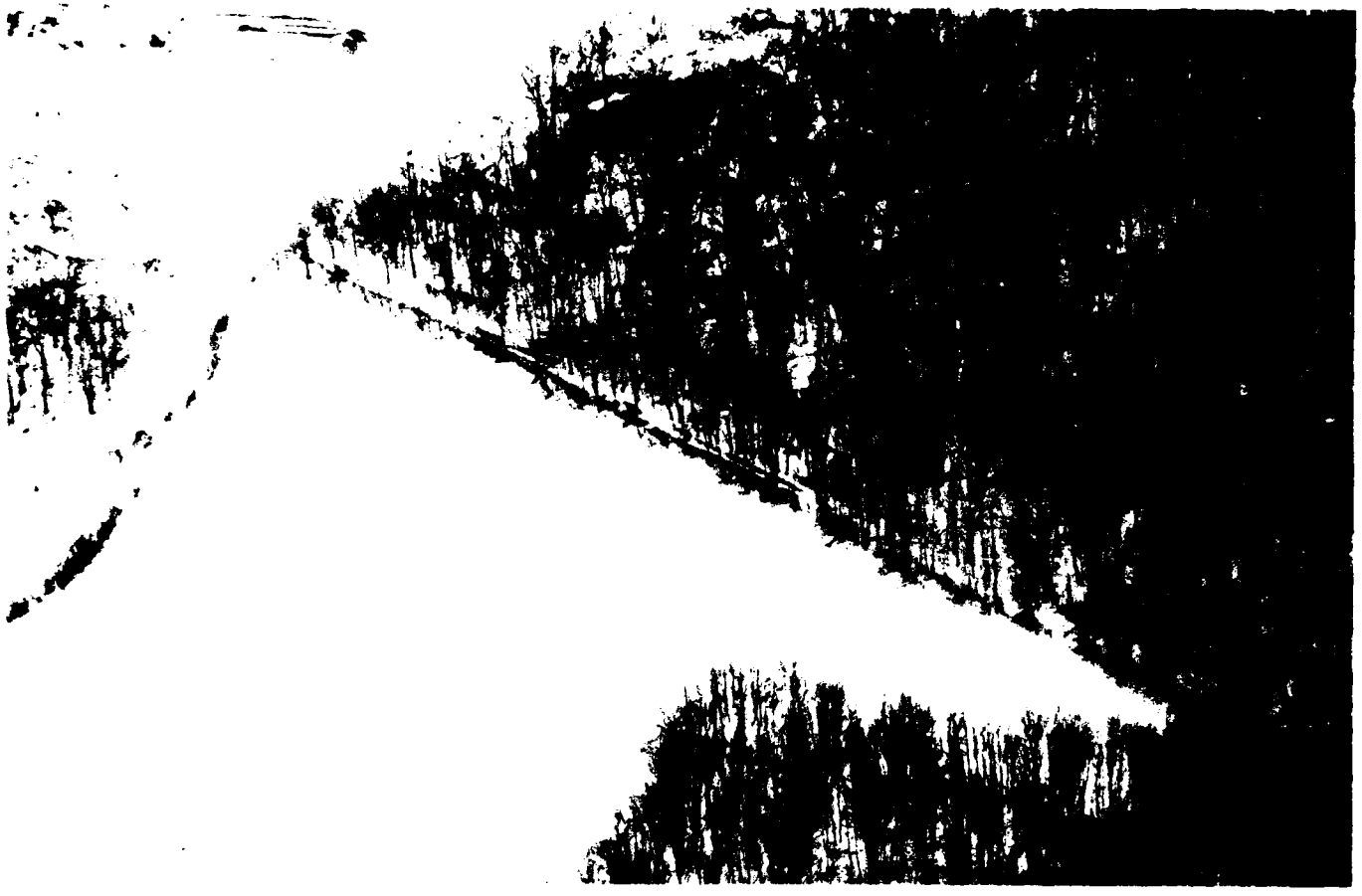
In addition, it is recommended that the following remedial measures be undertaken in the near future:

1) All trees and adverse vegetation on the embankment should be removed and the surfaces properly stabilized.
2) The outlet works should be investigated with respect to operational adequacy and then restored to proper operational condition.
3) The spillway structure should be thoroughly inspected with the lake drawn down. Spalled and deteriorated portions of the concrete should be repaired.
4) The embankment should be regraded to bring the low portion of the crest up to the elevation of the remainder of the embankment.
5) The downstream channel in the vicinity of the dam should be adequately protected against erosion.
6) The diversion channel should be adequately protected against erosion; especially along the toe of dam to prevent undermining of the embankment.
7) Debris in the downstream channel in the vicinity of the dam should be removed.

In the future, the owner of the dam should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam.

Richard J. McDermott, P.E.

John E. Gribbin, P.E.



OVERVIEW - CHEROKEE LAKE DAM

30 JANUARY 1981

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. It is important to note that the condition of dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that the unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydraulic and hydrologic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydraulic and hydrologic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

CHEROKEE LAKE DAM, I.D. NJ00785

SECTION 1: PROJECT INFORMATION

1.1 General

a. Authority

Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The Division of Water Resources of the New Jersey Department of Environmental Protection (NJDEP) in cooperation with the Philadelphia District of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the State of New Jersey. Storch Engineers has been retained by the NJDEP to inspect and report on a selected group of these dams. The NJDEP is under agreement with the Philadelphia District of the Corps of Engineers.

b. Purpose of Inspection

The visual inspection of Cherokee Lake Dam was made on December 24, 1980. The purpose of the inspection was to make a general assessment of the structural integrity and operational adequacy of the dam structure and its appurtenances.

1.2 Description of Project

a. Description of Dam and Appurtenances

The facilities at Cherokee Lake Dam consist of an earthfill dam with two uncontrolled spillways and one outlet works.

The earthfill embankment is approximately 585 feet long and extends approximately west to east. The embankment crest is about 8 feet wide. The downstream embankment slope is 2.5 horizontal to 1 vertical while the upstream face of the embankment has a slope of 1.0 horizontal to 1 vertical above the water line. The height of the dam is 11.4 feet.

The principal spillway consists of a two-stage concrete weir. The primary and secondary weirs of the spillway are broad crested weirs with effective lengths of 10.3 feet and 13.7 feet respectively. The secondary spillway crest elevation is 935.6 National Geodetic Vertical Datum (N.G.V.D.), while the elevation of the primary spillway is 935.0, about 3.3 feet below the embankment crest.

The outlet works consist of two low level pipes transversely penetrating the dam. The pipes are regulated by valves at their downstream end. The valves are enclosed in a cinder block housing at the downstream toe of the dam.

The emergency spillway is located adjacent to the right, or west, end of the embankment. The spillway consists of a grassed irregularly shaped low area in the lake bank. The spillway crest consists of a level section 20 feet in length at elevation 936.0. The outlet channel discharges into a diversion channel extending around the right side of the lake. The diversion channel is an earth channel connecting the inflow channel at the upstream end of the lake with the downstream channel.

b. Location

Cherokee Lake Dam is located in the Township of Randolph, Morris County, New Jersey. Constructed across India Brook, it impounds Cherokee Lake. India Brook joins the North Branch, Raritan River approximately 4.0 miles downstream from the dam. Principal access to the dam is by local roads off Sussex Turnpike about 2.5 miles south of its intersection with N.J. Route 10.

c. Size and Hazard Classification

The dam is classified in accordance with criteria presented in "Recommended Guidelines for Safety Inspection of Dams" published by the U.S. Army Corps of Engineers. Size categories consist of Small, Intermediate and Large while hazard categories are designated as Low, Significant and High.

Size Classification: Cherokee Lake Dam is classified as "Small" size since its maximum storage volume is 59 acre-feet (which is less than 1000 acre-feet) and its height is 11.4 feet (which is less than 40 feet).

Hazard Classification: Visual inspection of the downstream flood plain of the dam together with breach analysis indicate that failure of the dam due to overtopping would not inundate the two dwellings located adjacent to the downstream channel 2200 feet from the dam, and less than a few lives would be expected to be lost. Dam failure could, however, cause damage to the road bridge (Calais Road) located 2100 feet from the dam. Accordingly, Cherokee Lake Dam is classified as "Significant" hazard.

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Cherokee Lake Dam is located in the Township of Randolph, Morris County, New Jersey. Constructed across India Brook, it impounds Cherokee Lake. India Brook joins the North Branch, Raritan River approximately 4.0 miles downstream from the dam. Principal access to the dam is by local roads off Sussex Turnpike about 2.5 miles south of its intersection with N.J. Route 10.

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d. Ownership

Cherokee Lake Dam is owned by the Roman Catholic Diocese of Paterson, 777 Valley Road, Clifton, N.J. 07013. The property is leased by the Diocese of Paterson, Special Youth Services Program; Father Casey, Director.

e. Purpose of Dam

The purpose of the dam is the impoundment of a recreational lake facility.

f. Design and Construction History

The dam was designed in 1948 by the firm of N.M. Lake. Reportedly, no alterations or repairs have been made since the dam was constructed.

g. Normal Operational Procedures

Reportedly, no regular maintenance of the dam is performed. Regular maintenance of Cherokee Lake beach area reportedly is performed by The Special Youth Service Program.

1.3 Pertinent Data

a. Drainage Area	0.70 square miles
b. Discharge at Damsite	
Maximum flood at damsite	Unknown
Outlet works at normal pool elevation	20 cfs.
Spillway capacity at top of dam	412 cfs

c. Elevation (N.G.V.D.)

Top of Dam	937.5
Maximum pool-design surcharge	937.8
Principal spillway crest	935.0
Emergency spillway crest	936.0
Stream bed at centerline of dam	926.1
Maximum tailwater	932

d. Reservoir

Length of design surcharge	850 feet (Estimated)
Length of normal pool	600 feet (Scaled)

e. Storage (Acre-feet)

SDF maximum stage	61
Normal pool	35
Top of dam	59

f. Reservoir Surface (acres)

SDF maximum stage	15.0 (Estimated)
Normal pool	5.9
Top of dam	14.7 (Estimated)

g. Dam

Type	Earthfill
Length	680 feet
Height	11.4 feet
Sideslopes - Upstream	1 horiz. to 1 vert.
- Downstream	2.5 horiz. to 2 vert.
Zoning	Clay/Fine Clay
Impervious core	Unknown

	Cutoff	Clay trench along centerline of dam
	Grout curtain	None
h.	Diversion and Regulating Tunnel	N.A.
i.	Spillway	
	Type	Concrete Weir
	Length of weir - Primary	10.3 feet
	- Secondary	13.7 feet
	Crest elevation	935.0
	Gates - Primary	935.6
	- Secondary	N.A.
	Upstream channel	N.A.
	Downstream channel	Natural Stream
j.	Emergency Spillway	
	Type	Irregular grassed channel
	Bottom width	20 feet
	Sideslopes	Irregular
	Crest elevation	936.0
	Gates	None
	Upstream slope	Unknown
	Downstream slope	Unknown
k.	Regulating Outlet	
	Twin 10" dia. pipes (Non-operable)	

SECTION 2: ENGINEERING DATA

2.1 Design

Construction drawings titled "Proposed Dam at Mt. Freedom" prepared by N.M. Lake, Civil Engineer, for the Mt. Freedom Development Corp., dated March 10, 1948, are available in the files of the NJDEP, Division of Water Resources.

In addition, hydraulic/hydrologic design calculations and construction specifications are contained in the NJDEP file and are summarized as follows:

Design inflow was based on an average of the North Jersey and Central Jersey curves and was found to be 300 c.f.s. Spillway discharge capacity with freeboard was found to be 354 c.f.s. The spillway discharge calculations did not account for a low area (emergency spillway) along the lake shore.

2.2 Construction

Cherokee Lake Dam was constructed in 1948 by N.M. Lake, who also prepared the construction drawings. Five inspections were performed by the State of New Jersey during and after construction operations. As a result of inspection, it was found that approximately 250 feet of the embankment on the right side of the spillway, looking downstream, was up to 6 inches below the grade shown on the approved drawings. The State then advised the owner to establish the present grade at an elevation approximately 6 inches above the approved grade in order to allow for settlement.

Final inspection indicated that the dam had been completed in accordance with approved drawings.

In addition, two monthly progress reports and photos of the dam are contained in the NJDEP file.

2.3 Operation

Correspondence relating to the operation of the dam is available in the NJDEP file. The correspondence concerns complaints made in behalf of residents downstream from the dam who were concerned that the filling and subsequent operation of the lake would deprive them of the stream flow to which they were accustomed.

Additional correspondence indicates concern about possible effects of the dam on the quality of drinking water for the Borough of Mendham. Condition 10 of the New Jersey Water Policy Commission Permit provides for the eventual construction and maintenance of a water treatment plant downstream from the dam if needed to protect the Mendham drinking water supply. No evidence of construction of such treatment plant was obtained.

2.4 Evaluation

a. Availability

Available engineering information is limited to that which is on file with the NJDEP.

b. Adequacy

The NJDEP file information was of significant assistance in the performance of a Phase I evaluation. However, complete information needed to properly evaluate the dam was not available. A list of absent information is included in paragraph 7.1.b.

c. Validity

The available hydraulic analyses appear to be valid with respect to engineering practice generally accepted in 1948. However, they are not valid according to analytic procedures developed by the Corps of Engineers for the present inspection and assessment program.

It should be noted that concern was expressed by the State of New Jersey at the time of design that care should be taken to ensure that the design elevation of the top of dam be adhered to since hydraulic design was based on no freeboard.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General

Cherokee Lake Dam was inspected on December 24, 1980 by members of the staff of Storch Engineers. A copy of the visual inspection checklist is contained in Appendix 1. The following procedures were employed for the inspection:

1) The embankment of the dam, appurtenant structures and adjacent areas were examined.
2) The embankment and accessible appurtenant structures were measured and key elevations were determined by surveyor's level.
3) The embankment, appurtenant structures and adjacent areas were photographed.
4) The immediate downstream flood plain was toured to evaluate downstream development and restricting structures.

b. Dam

The upstream and downstream sides of the dam were thickly overgrown with trees, bushes and briars. The trees ranged in size from 2 inches to 12 inches. The grading of the downstream side appeared to be fairly uniform. The grading of the crest however, was fairly uniform for about 150 feet to the right of the spillway, at which point the crest elevation dropped about one foot and became more irregular. Also, at the point where the crest dropped, the downstream slope became steeper.

The upstream face of the dam appeared to be well graded, although there was no evidence of riprap. No animal holes were observed on the dam.

Seepage was observed at two locations along the toe of dam right of the outlet works. The seepage was in the form of wet spongy areas with standing water. The standing water was not frozen although the lake water was frozen. One area of standing water approximately 40 feet right of the outlet works had dimensions of 5 feet wide and 8 feet long, while the other area was about 1 foot square.

c. Appurtenant Structures

Principal Spillway

The general condition of the spillway was deteriorated. The primary stage of the weir, which consisted of a cut in its center, was considerably eroded and spalled due to overflow. The secondary stage appeared to be in generally satisfactory condition. At the downstream end of the apron, the discharge drops about 4 feet to a stilling basin below. The stilling basin contained a significant amount of debris, although some of it was obscured by considerable amounts of ice and snow. The timber sheetpile cutoff wall under the downstream end of the apron was mostly obscured by ice and snow. The left training wall was very deteriorated. The upstream end of the training wall at the waterline was completely eroded and spalled so that the upstream end is suspended with two reinforcing rods protruding from it down to the waterline. There was also considerable spalling over about 50 percent of the inside surface of the training wall. Also the edge of the training wall along the downstream side at the top was considerably spalled.

The pedestrian bridge spanning the spillway was rusted although it appeared generally sound.

Outlet Works

A gate housing structure was observed at the toe of dam consisting of four cinder block walls which apparently at one time supported a roof. The roof was almost completely gone and the left cinder block wall had collapsed and was leaning on the left gate operating mechanism. The two gate operating mechanisms were rusted and did not appear to be in operational condition. The discharge end of the outlet pipes could not be observed. It appeared that the entire bottom of the structure was composed of soft spongy soil. The diversion stream which flows around the lake was located approximately 10 feet downstream from the gates.

d. Reservoir Area

The upstream end and right side of the reservoir was thickly wooded with banks approximately 3 to 5 feet high and the terrain beyond the banks sloping up gradually at a grade of approximately 4 percent. Along the left side of the lake the terrain is much more open and grass covered with an apparent beach comprising a portion of the area. Generally, the shore slopes along the left side were approximately 8 percent to a height of about 5 feet over the lake and then leveled off to a relatively flat slope.

e. Downstream Channel

The downstream channel is a natural stream with three to five foot high banks and a cobbly bottom. It is thickly wooded to the waterline. Approximately 75 feet downstream from the spillway the downstream channel joins the diversion channel which flows around the right side of the lake. Immediately downstream from the confluence there appeared to be considerable debris in in the stream. In the immediate vicinity of

the spillway and between the spillway and the confluence there was evidence of significant erosion on the banks of the downstream channel. Soil had been loosened and roots of trees exposed. Also, erosion was observed on the bank of the diversion channel at its bend point at the right end of the dam. The top of the erosion was approximately 2 1/2 to 3 feet above the invert of the stream, indicating occasional high flow.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures

The level of water in Cherokee Lake Dam is regulated naturally by discharge over the spillway of the dam. Reportedly, the outlet is not used during times of intense storms to augment the spillway capacity.

4.2 Maintenance of the Dam

According to the owner and tenant of the property, there is no program of regular maintenance of the dam and appurtenant structures.

4.3 Maintenance of Operating Facilities

Reportedly, there is no program of regular maintenance of the operating facilities.

4.4 Description of Warning System

Reportedly, no formal warning system is in use at the present time.

4.5 Evaluation of Operational Adequacy

The operation of the dam has been adequate to the extent that the dam reportedly has never been overtopped.

Maintenance documentation is poor and maintenance has been inadequate in the following areas:

1) Trees and brush on embankment.
2) Debris in spillway discharge channel.
3) Outlet works not functioning properly.
4) Spalled and deteriorated concrete and cracks on spillway training walls.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data

The quantity of storm water runoff that the spillway should be able to handle is based on the size and hazard classification of the dam. This runoff quantity, called the spillway design flood (SDF) is described in terms of return frequency or probable maximum flood (PMF) depending on the extent of the dam's size and potential hazard. According to the "Recommended Guidelines for Safety Inspection of Dams" published by the U.S. Army Corps of Engineers, the SDF for Cherokee Lake Dam falls in a range of 100-year frequency to 1/2 PMF. In this case, the low end of the range, 100-year frequency, is chosen since the factors used to select size and hazard classification are on the low side of their respective ranges.

The SDF inflow hydrograph for Cherokee Lake Dam (See Appendix 4) was calculated by the Soil Conservation Service Triangular Unit hydrograph method with the curvilinear transformation utilizing the HEC-1-DAM computer program.

General hydrologic characteristics used in this method were computed using USGS quadrangles. The drainage area contributing to the impoundment is 0.52 square miles. Most of the water shed is suburban and farm land. The SDF peak inflow was computed to be 739 c.f.s.

The spillway discharge rates were computed by the use of a weir formulae appropriate for the configurations of the principal and emergency spillways. The total spillway discharge with lake level equal to the top of the dam was computed to be 412 c.f.s. The SDF was routed through the dam by use of the

HEC-1-DAM computer program using the modified Puls Method. In routing the SDF, it was found that the dam crest would be overtopped by a depth of 0.3 feet. Accordingly, the subject spillways are assessed as being inadequate in accordance with criteria developed by the U.S. Army Corps of Engineers.

A dam breach analysis was then performed using a trapezoidal breach section with bottom length of 200 feet and sideslopes of 1 horizontal to 1 vertical. The breach peak outflow was computed to be 1850 c.f.s. Dam breach computations are contained in Appendix 4.

The breach analysis indicates that dam failure from over topping would not cause inundation of the two dwellings located 2200 feet downstream from the dam.

b. Experience Data

Reportedly Cherokee Lake Dam has never experienced overtopping or flow through the emergency spillway since construction in 1948.

c. Visual Observation

At the time of the field inspections there was no evidence of recent overtopping or flow in the emergency spillway.

d. Overtopping Potential

As indicated in paragraph 5.1.a. a storm of magnitude equal to the SDF would cause overtopping of the dam to a height of 0.3 feet over the crest of the dam. The elevation of the crest of dam was taken to be 937.5 which is the lower portion of the embankment crest observed at the time of inspection. The maximum crest elevation was measured to be 938.4. The spillways

are capable of passing approximately 56 percent of the SDF with the lake level equal to elevation 937.5.

The lower portion of the embankment crest appeared to be the same portion noted by the State Water Policy Commission in 1948 as having settled.

e. Drawdown Time

Reportedly, the lake has never been drawn down, therefore experience data is not available. Based on available information the calculated drawdown time (See Appendix 4) would be approximately 1.7 days.

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observation

The dam appeared, at the time of inspection to be outwardly structurally sound with no evidence of embankment cracks or distress. Evidence of seepage was observed at two locations along the toe of dam, but does not appear to be an indication of distress in the embankment.

b. Generalized Soils Description

Generally, surficial soils at the dam site consist of silt, silty clay and silty sand, usually containing considerable rock fragments overlying the Gneissic bedrock.

c. Design and Construction Data

The analysis of structural stability and construction data for the embankments are not available.

d. Operating Records

Operating records for the dam and appurtenances are not available.

e. Post Construction Changes

Based on construction drawings in the NJDEP file and field inspections, there have been no external changes in the dam or appurtenances since their construction in 1948. A diversion channel is located along a portion of the toe of dam and could comprise a post construction change.

f. Seismic Stability

Cherokee Lake Dam is located in Seismic Zone 1 as defined in "Recommended Guidelines for Safety Inspection of Dams," which is a zone of very low seismic activity. Experience indicates that dams in Seismic Zone 1 will have adequate stability under seismic loading conditions, if stable under static loading conditions. This dam appears to be stable under static loading based on field inspection observations.

SECTION 7: ASSESSMENT AND RECOMMENDATIONS

7.1 Dam Assessment

a. Safety

Based on the hydraulic and hydrologic analyses outlined in Section 5 and appendix 4, the spillway of Cherokee Lake Dam is assessed as being inadequate. The spillways are not able to pass the SDF without an overtopping of the dam.

The embankment appeared at the time of inspection, to be generally outwardly stable. Observed seepage at the toe was not considered to be evidence of immediate dam instability.

b. Adequacy of Information

Information sources for this study included: 1) field investigations, 2) data from the NJDEP file (dam inspection reports, correspondence and the "Application for Permit for Construction or Repair of Dam"), 3) original construction drawings for the dam, 4) USGS quadrangles and 5) consultation with Diocese of Paterson, N.J. personnel. This information is adequate for a Phase I Assessment as outlined in "Recommended Guidelines for Safety Inspection of Dams."

c. Necessity for Additional Data/Evaluation

The data available and the evaluations performed are considered to be sufficient to permit a Phase I assessment of Cherokee Lake Dam.

7.2 Recommendations

a. Remedial Measures

Based on hydraulic and hydrologic analyses outlined in paragraph 5.1.a, the spillway is considered to be inadequate. It is therefore recommended that a professional engineer experienced in the design and construction of dams be engaged in the near future to perform more accurate hydraulic and hydrologic analyses relating to spillway capacity. Based on the findings of these analyses, the need for and type of remedial measures should be determined and then implemented.

The owner should, in the near future, develop an emergency action plan together with an effective warning system outlining actions to be taken by the operator to minimize downstream effects of an emergency at the dam.

In addition, it is recommended that the following remedial measures be undertaken in the near future:

1) All trees and adverse vegetation on the embankment should be removed and the surfaces properly stabilized.

2) The outlet works should be investigated with respect to operational adequacy and then restored to proper operational condition.

3) The spillway structure should be thoroughly inspected with the lake drawn down. Spalled and deteriorated portions of the concrete should be repaired.

4) The embankment should be regraded to bring the low portion of the crest up to the elevation of the remainder of the embankment.

5) The downstream channel in the vicinity of the dam should be adequately protected against erosion.

6) The diversion channel should be adequately protected against erosion; especially along the toe of dam to prevent undermining of the embankment.

7) Debris in the downstream channel in the vicinity of the dam should be removed.

In the near future, the owner of the dam should develop written operating procedures and a periodic maintenance plan to insure the safety of the dam.

b. Maintenance

In the future, the owner of the dam should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam.

c. Additional Studies

Two areas of seepage were observed at the toe of dam. Arrangements should be made in the near future to monitor the seepage in order to detect any changes in its condition. The monitoring should be performed by a professional engineer experienced in the design and construction of dams.

PLATES

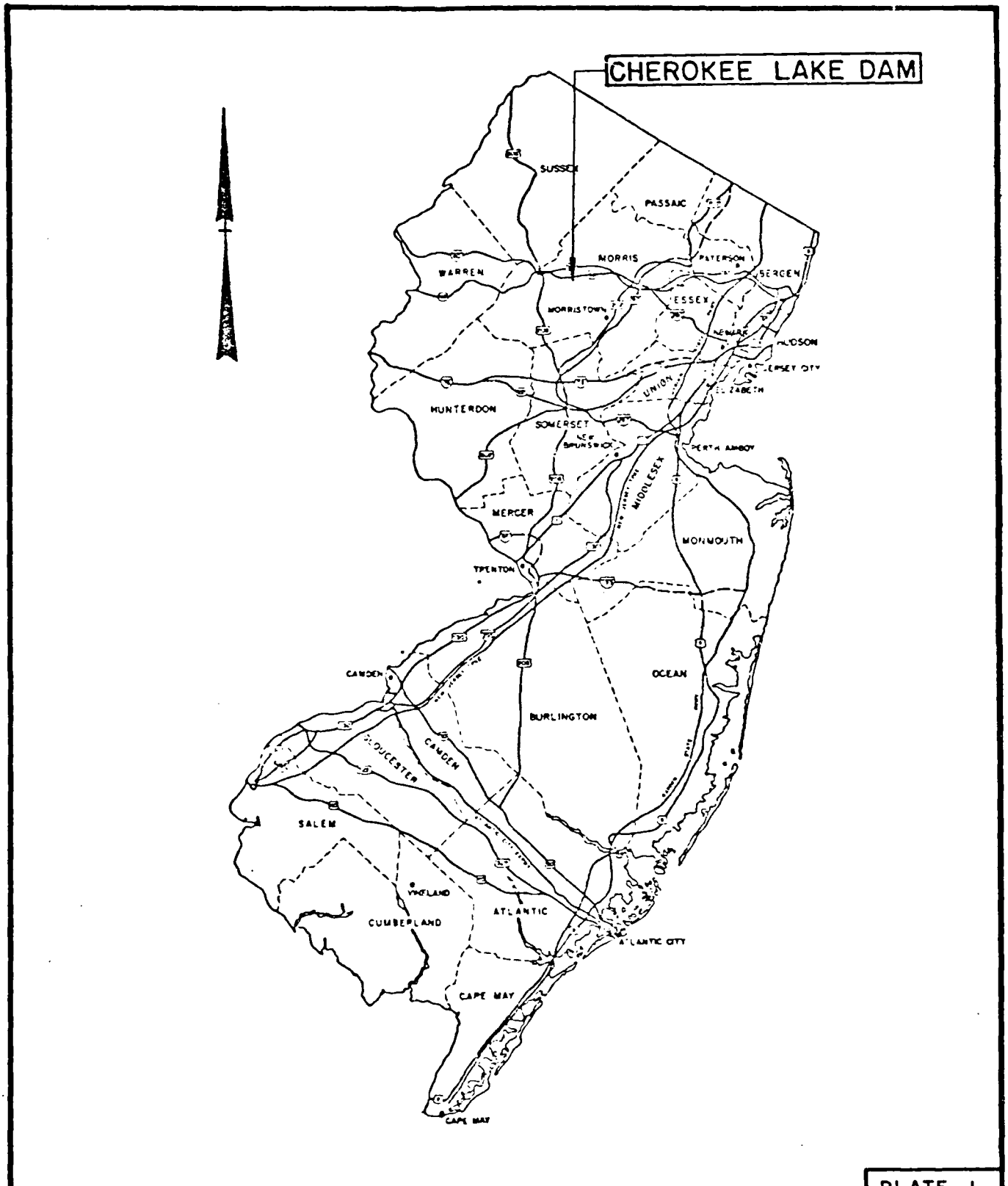


PLATE 1

STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	INSPECTION AND EVALUATION OF DAMS KEY MAP CHEROKEE LAKE DAM
DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY	SCALE: NONE DATE: FEB. 1981

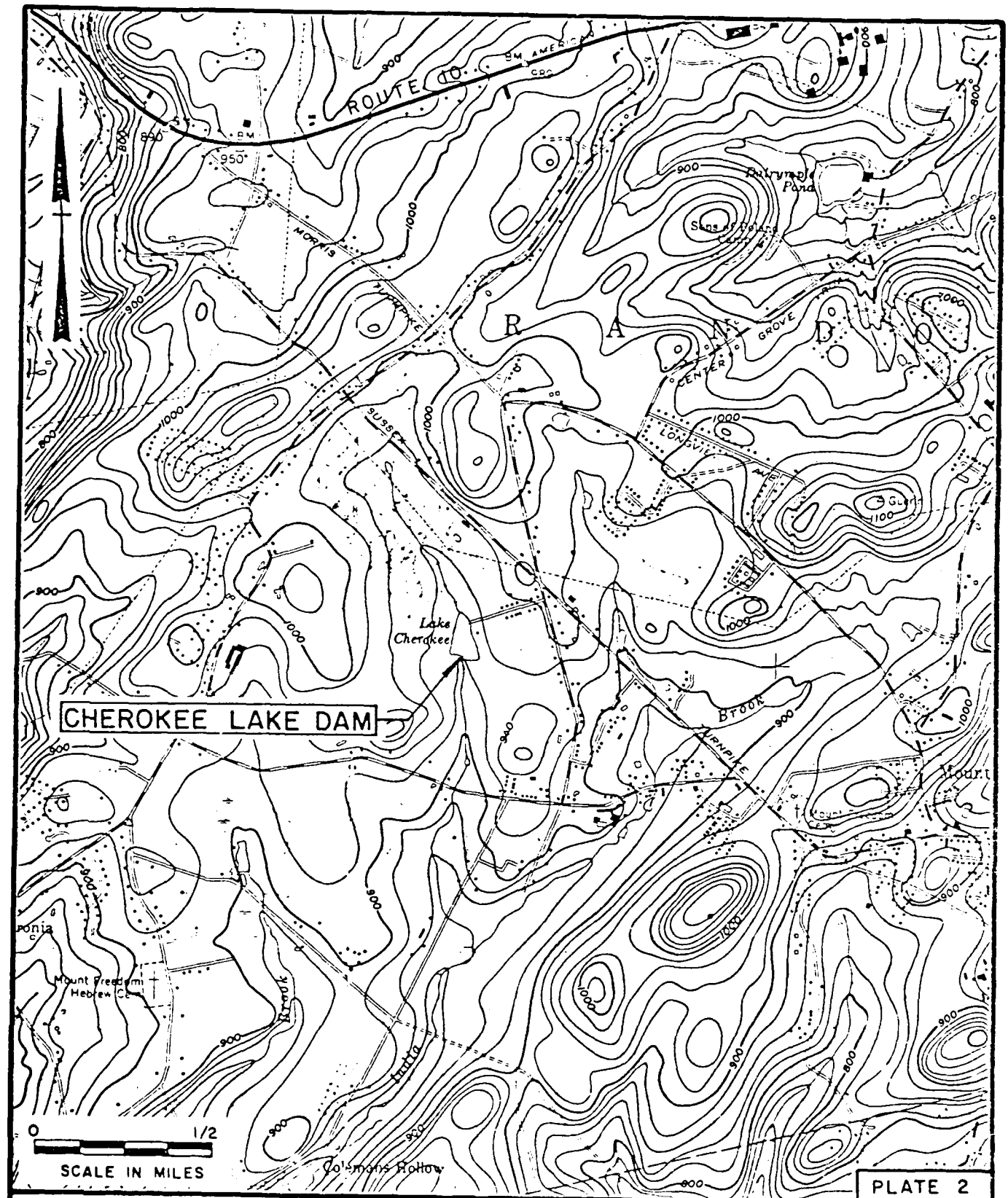


PLATE 2

STORCH ENGINEERS
FLORHAM PARK, NEW JERSEY

DIVISION OF WATER RESOURCES
N.J. DEPT. OF ENVIR. PROTECTION
TRENTON, NEW JERSEY

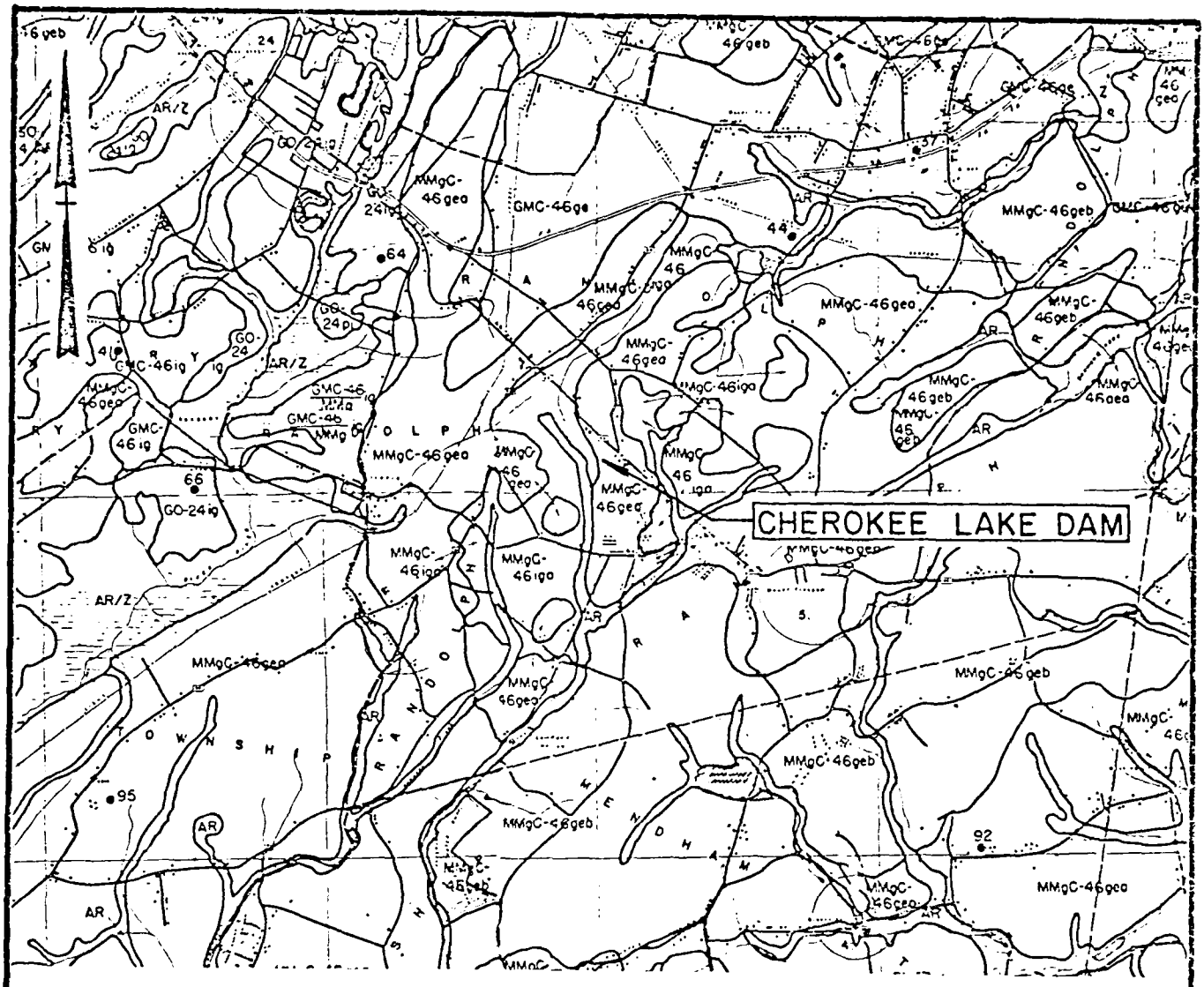
INSPECTION AND EVALUATION OF DAMS

VICINITY MAP

CHEROKEE LAKE DAM

SCALE: AS SHOWN

DATE: FEB. 1981



Legend

MMgC-46 Silt, silty clay and silty sand, usually containing considerable rock fragments overlying Gneissic bedrock.

Note: Information taken from: Rutgers University Engineering Soil Survey of New Jersey, Report No. 9, Morris County, November 1953 and Geologic Map of New Jersey prepared by J. V. Lewis and H. Kummel 1910-1912, revised by H. B. Kummel 1931 and M. Johnson 1950.

PLATE 3

STORCH ENGINEERS FLORHAM PARK, NEW JERSEY.	INSPECTION AND EVALUATION OF DAMS SOIL MAP CHEROKEE LAKE DAM
DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY	SCALE: NONE DATE: FEB. 1981

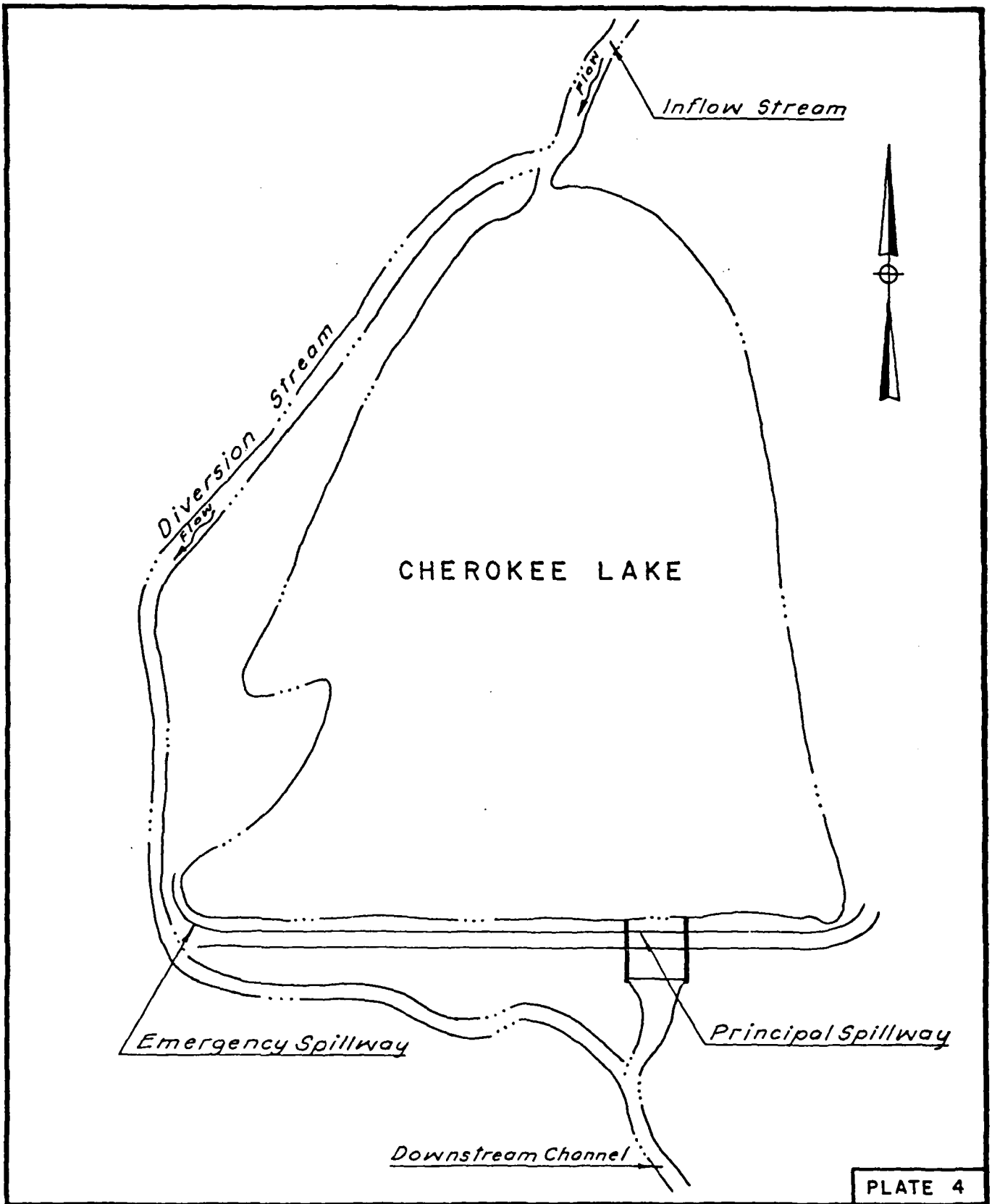
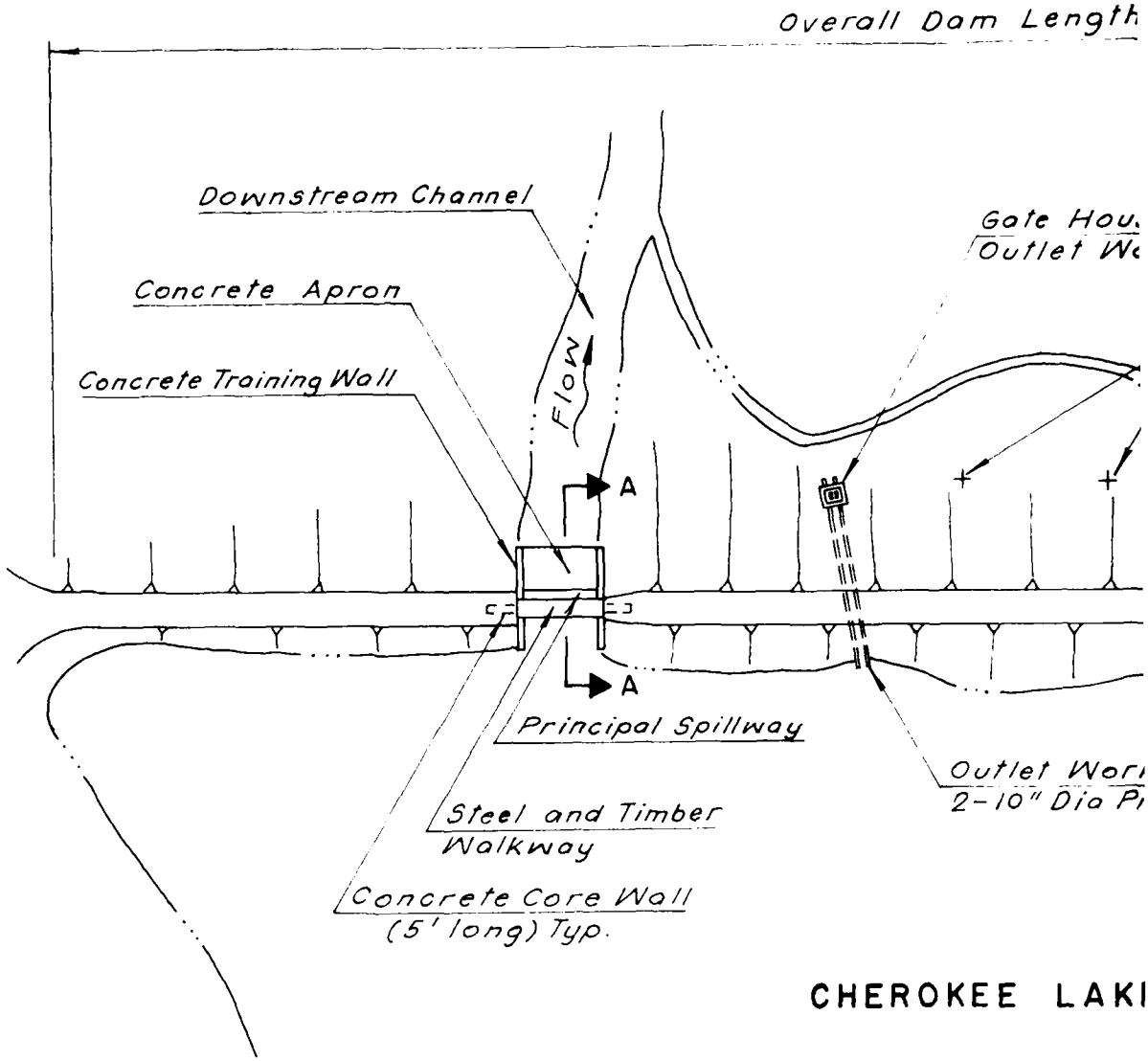


PLATE 4

STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	INSPECTION AND EVALUATION OF DAMS OVERVIEW CHEROKEE LAKE DAM
DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY	I.D.N.J. 00785 | SCALE: NONE DATE: FEB. 1981



CHEROKEE LAKE

Note:
Information taken from plans titled "Proposed Dam at Mt. Freedom" prepared by N.M. Loke for Mt. Freedom Development Corp. March 10, 1948 and field inspection December 24, 1980

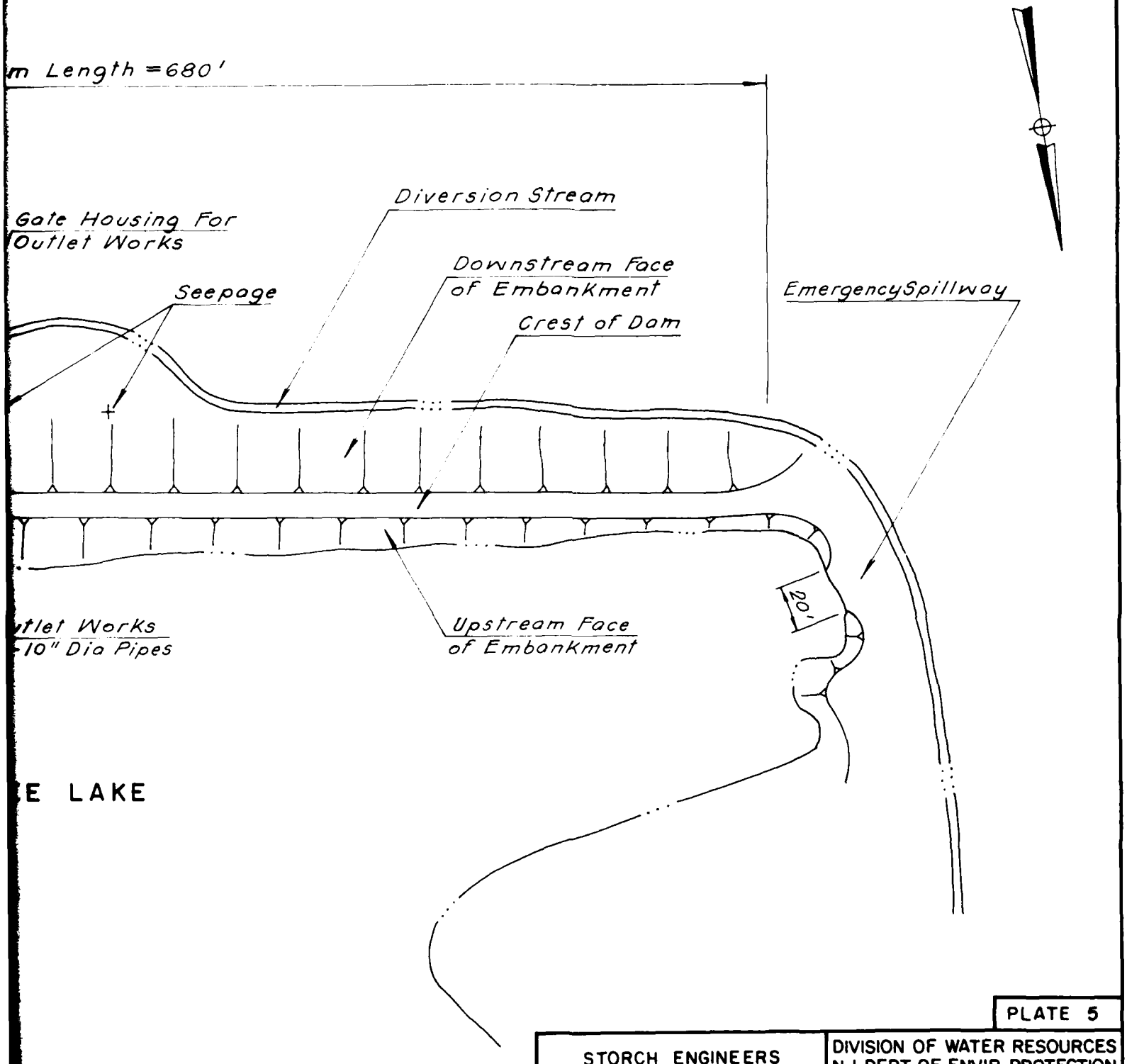


PLATE 5

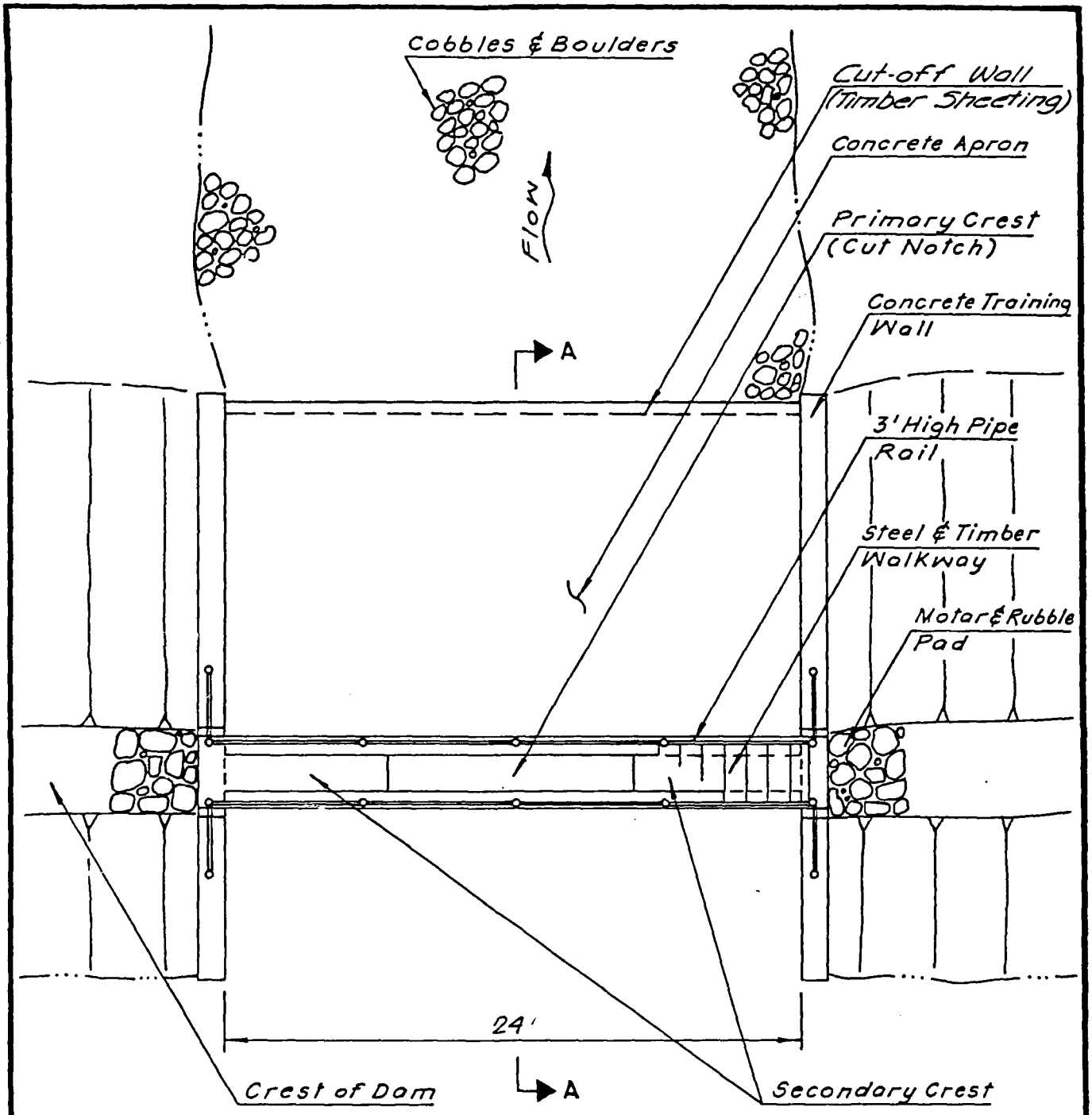
STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

GENERAL PLAN

CHEROKEE LAKE DAM

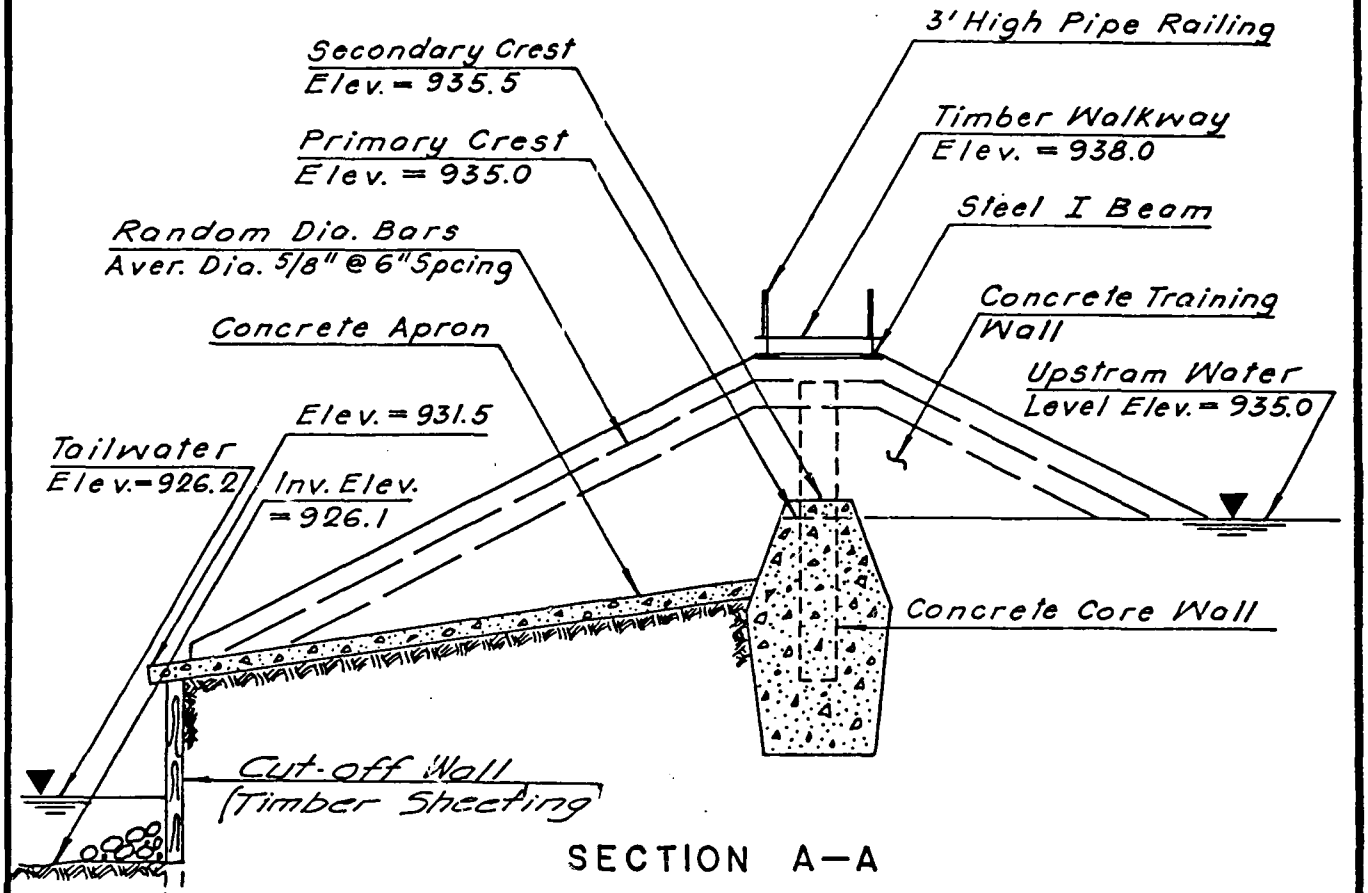
I.D N.J. 00785	SCALE: NOT TO SCALE
	DATE: FEB 1981



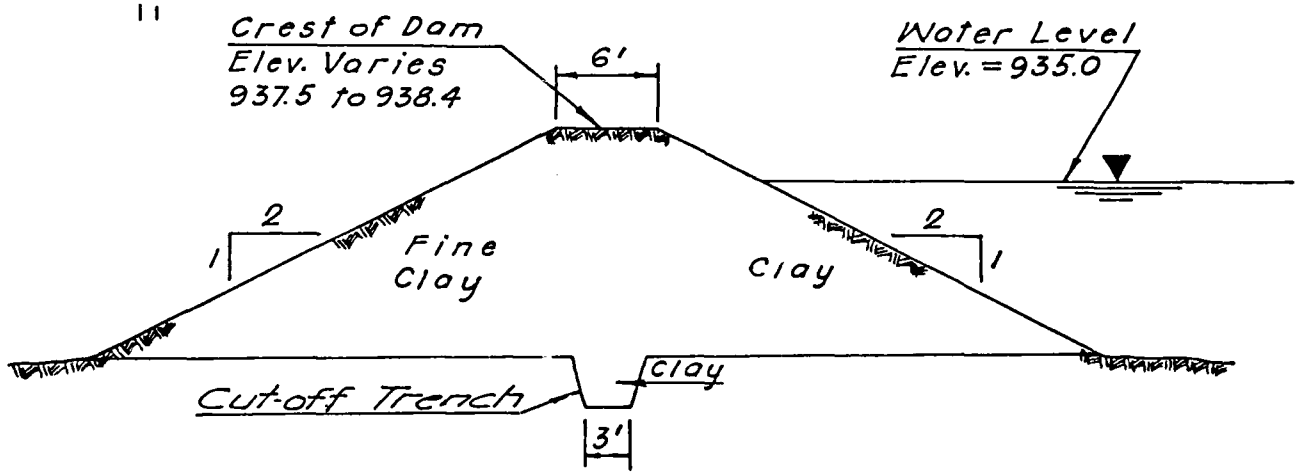
CHEROKEE LAKE

PLATE 6

STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	INSPECTION AND EVALUATION OF DAMS SPILLWAY PLAN CHEROKEE LAKE DAM
DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY	I.D. N.J. 00785 — SCALE: NONE DATE: FEB. 1981



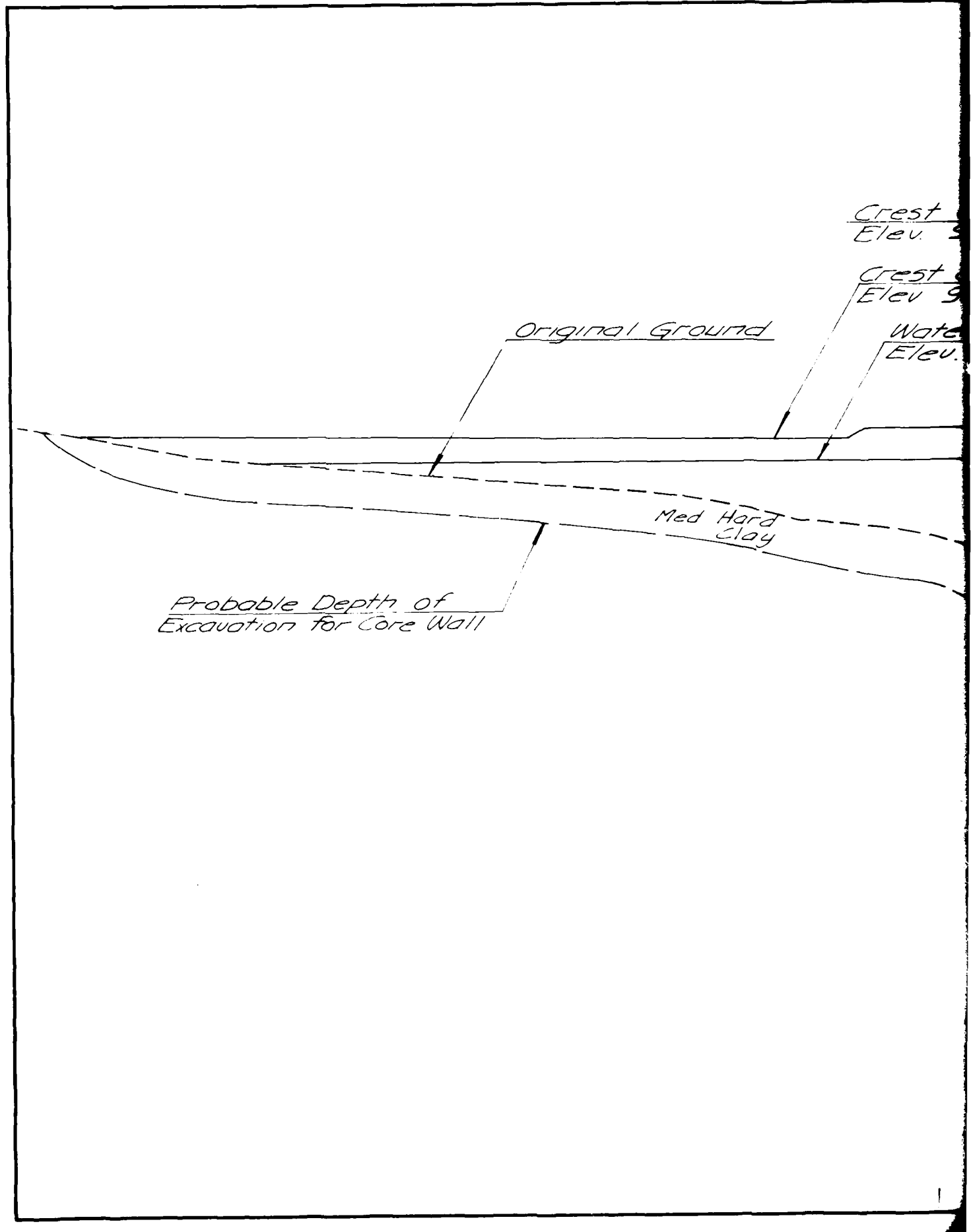
SECTION A—A



TYPICAL DAM SECTION

PLATE 7

STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	INSPECTION AND EVALUATION OF DAMS SECTIONS CHEROKEE LAKE DAM
DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY	I.D. N.J. 00785 — SCALE: NONE DATE: FEB. 1981


Crest
Elev.
Crest
Elev
Original Ground
Wate
Elev.
Med Hard
Clay
Probable Depth of
Excavation for Core Wall

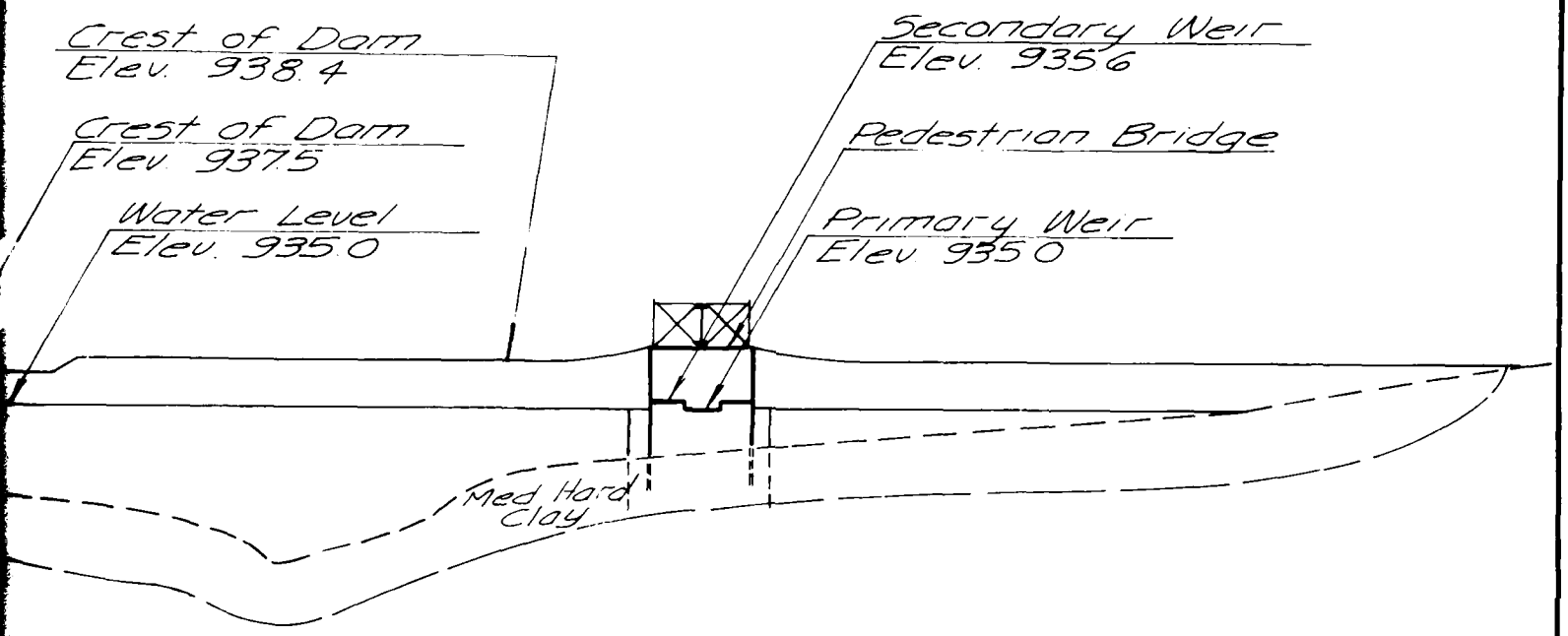


PLATE 8

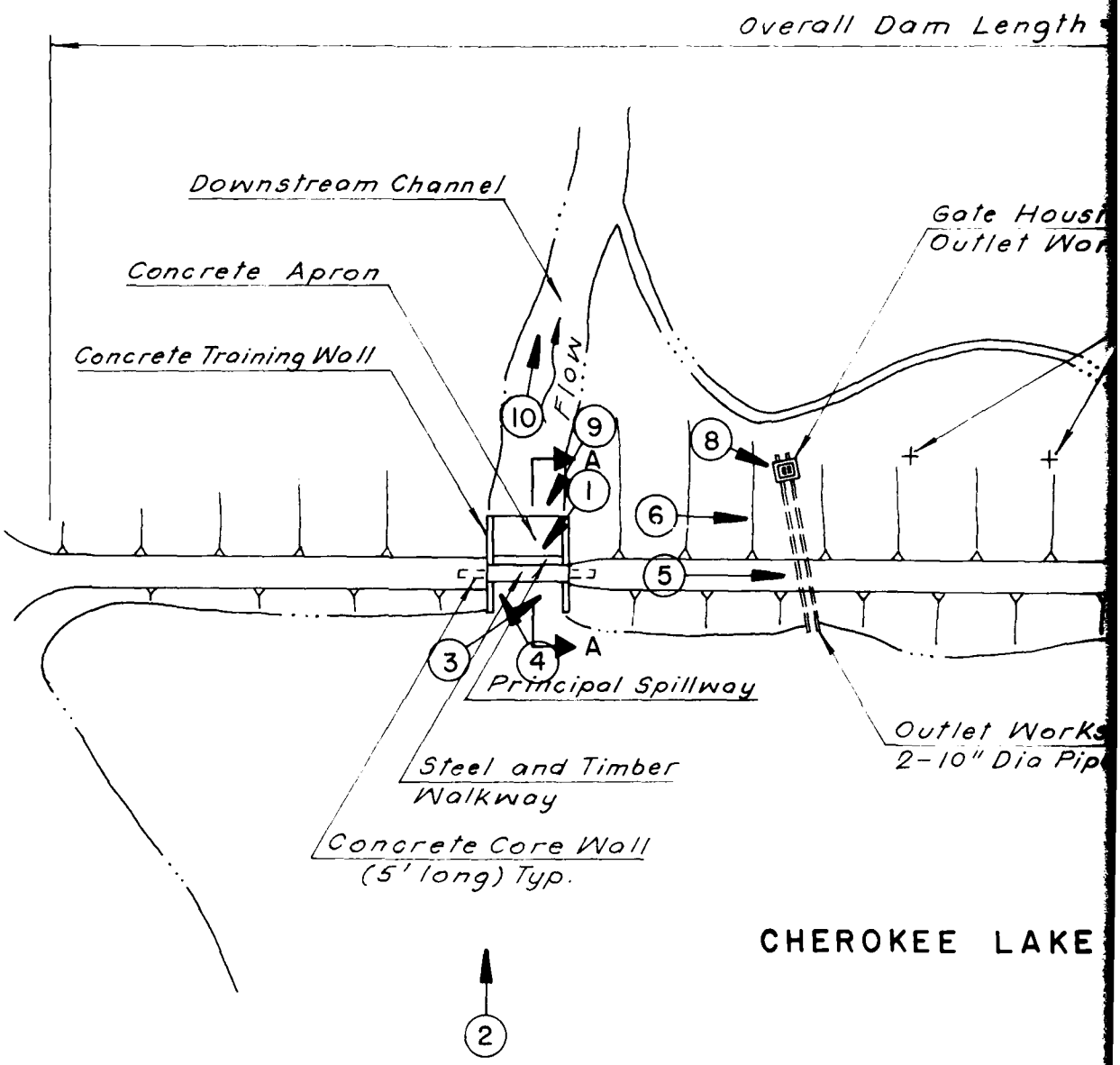
STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

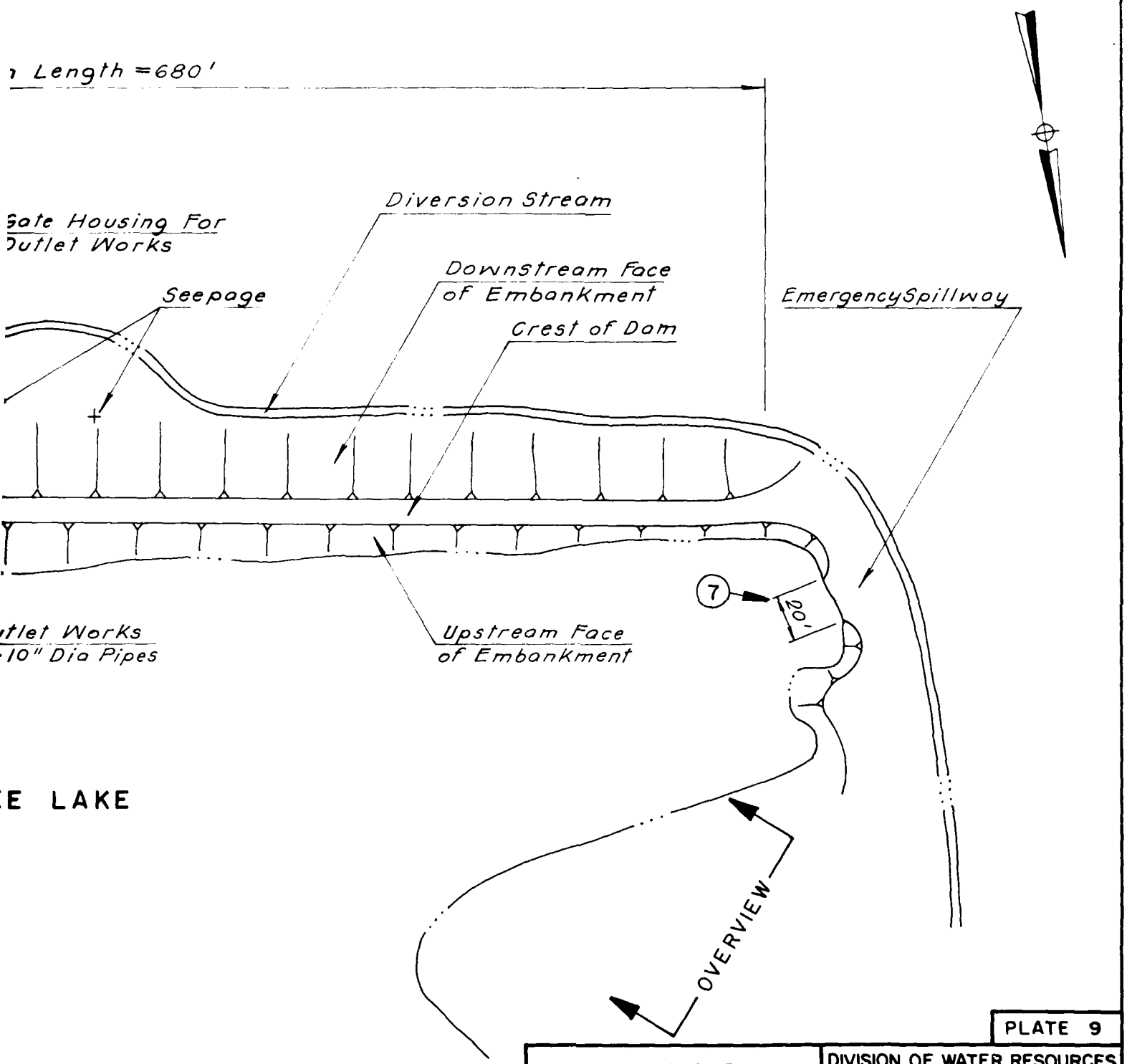
LONGITUDINAL SECTION

CHEROKEE LAKE DAM

I.D. N.J. 00785	SCALE: NOT TO SCALE
	DATE: FEB. 1981



Note:
Information taken from plans titled "Proposed Dam at Mt. Freedom" prepared by N.M. Lake for Mt. Freedom Development Corp. March 10, 1948 and field inspection December 24, 1980



E LAKE

PLATE 9

STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

PHOTO LOCATION PLAN

CHEROKEE LAKE DAM

I.D. N.J. 00785	SCALE: NOT TO SCALE
	DATE: FEB. 1981

APPENDIX 1

Check List - Visual Inspection

Check List - Engineering Data

Check List

Visual Inspection

Phase I

Name of Dam Cherokee Lake Dam County Morris State N.J. Coordinators NJDEP

Date(s) Inspection 12/24/80 Weather Cloudy Temperature 30°F

Pool Elevation at time of Inspection 935.0 M.S.L. Tailwater at Time of Inspection 926.2 M.S.L.

Inspection Personnel:

John Gribbin Mark Brady

Charles Osterkorn Richard McDermott

~~Daniel Buckelew~~

John Gribbin Recorder

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
GENERAL	Upstream and downstream sides overgrown with trees (2" to 12"), bushes and briars.	Trees and adverse vegetation should be removed.
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Junctions appeared stable.	
ANY NOTICEABLE SEEPAGE	Two areas of seepage at toe-observed as soft spongy areas with standing water. The water was not frozen although lake water was frozen. One area, about 20' right of outlet works, measured 1' square; the other, about 40' right of outlet, measured 5' by 8'. Also, wet, spongy condition in bottom of outlet gate housing.	Seepage should be monitored.
STAFF GAGE AND RECORDER	None observed.	
DRAINS	None observed.	

EMBANKMENT

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None observed.	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Vertical: 1. Section at right end about 285' long irregular with approx. elev. 937.5 2. Remainder generally level at elev. 938.4 Horizontal: generally straight	Downstream side steeper in area of lower crest elev. than in remainder of embankment.
RIPRAP	None observed.	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SURFACES IN OUTLET CONDUIT	Could not be observed.	
INTAKE STRUCTURE	Submerged, could not be observed.	
OUTLET STRUCTURE	Could not be observed. However, outlet appeared to be located at gate housing.	
OUTLET CHANNEL	Outlet discharges into earth channel which extends to the diversion channel about 10 feet from the gate housing.	
GATE AND GATE HOUSING	Cinder block gate housing in deteriorated condition. Timber roof almost completely deteriorated and displaced. Left cinder block wall collapsed and resting on left gate operating mechanism. Gate operating mechanisms were severely rusted and did not appear to be operational.	Outlet works should be restored to operational condition.

SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
WEIR	Primary crest significantly spalled and eroded due to overflow. Secondary weir in generally satisfactory condition.	Primary weir crest should be repaired
TRAINING WALLS	Left wall severely deteriorated. Upstream end at water line completely spalled leaving wall suspended and reinforcing exposed. Also, about 50% of surface of wall spalled. Right wall moderately deteriorated with surface cracks and spalling at upstream and downstream ends.	Training walls should be repaired.
APRON	Appeared generally sound with surface significantly eroded by water flow. Timber sheeting cut-off wall below downstream end appeared sound but was almost completely obscured by ice and snow.	
DISCHARGE CHANNEL	Spillway discharges directly into downstream channel.	
BRIDGE	Pedestrian bridge generally sound although walkway and railings significantly rusted. Also, chicken wire on railings severely rusted and partially displaced.	

INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None	
OBSERVATION WELLS	None	
WEIRS	None	
PIEZOMETERS	None	
OTHER		

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Upstream and right side wooded with 3' to 5' banks and moderate (4%) terrain beyond. Left side grass covered with beach comprising a portion of shore. Slopes approx. 8%.	
SEDIMENTATION	Unknown.	
STRUCTURES ALONG BANKS	None observed.	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTION, DEBRIS, ETC.)	Natural stream with cobble lined bed. Channel banks thickly wooded with significant erosion in vicinity of dam. Debris observed in channel within 100' of dam. Diversion channel joins downstream channel about 75' downstream from dam. Diversion channel significantly eroded at bend point adjacent to right end of dam; erosion extends 2½' to 3' above invert.	Debris should be removed. Channel banks should be properly stabilized.
SLOPES	Banks about 3' to 5' high	
STRUCTURES ALONG BANKS	Road bridge (Calais Rd.) spans channel 2100' from dam. Two dwellings adjacent to stream 2200' from dam. Dwellings min. 10' above stream.	

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM			REMARKS
DAM	-	PLAN	Available: Plans titled "Proposed Dam at Mt. Freedom" prepared by N.M. Lake, dated March 10, 1948 (4 sheets)
		SECTIONS	
SPILLWAY	-	PLAN	Available: N.M. Lake plans
		SECTIONS	
		DETAILS	
OPERATING EQUIPMENT PLANS & DETAILS			Not Available
OUTLETS	-	PLAN	Available: N.M. Lake plans
		DETAILS	Not Available
		CONSTRAINTS	Not Available
		DISCHARGE RATINGS	Not Available
HYDRAULIC/HYDROLOGIC DATA			Available in NJDEP file
RAINFALL/RESERVOIR RECORDS			Not Available
CONSTRUCTION HISTORY			Available: correspondence, inspection reports and monthly progress reports in NJDEP file
LOCATION MAP			Not Available

ITEM	REMARKS
DESIGN REPORTS	Not Available
GEOLOGY REPORTS	Not Available
DESIGN COMPUTATIONS	Available: hand written calculations in NJDEP file
HYDROLOGY & HYDRAULICS	
DAM INSTABILITY	Not Available
SEEPAGE STUDIES	Not Available
MATERIALS INVESTIGATIONS	Not Available
BORING RECORDS	
LABORATORY	
FIELD	
POST-CONSTRUCTION SURVEYS OF DAM	Not Available
BORROW SOURCES	Not Available

ITEM	REMARKS
MONITORING SYSTEMS	Not Available
MODIFICATIONS	Correspondence in NJDEP file refers to addition of concrete apron and timber sheeting cutoff wall at spillway. These appeared to have been constructed.
HIGH POOL RECORDS	Not Available
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Not Available
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	Not Available
MAINTENANCE OPERATION RECORDS	Not Available

APPENDIX 2

Photographs

PHOTO 1

CREST OF SPILLWAY

PHOTO 2

UPSTREAM VIEW OF SPILLWAY

CHEROKEE LAKE DAM
24 DECEMBER 1980

PHOTO 3

RIGHT SPILLWAY TRAINING WALL

PHOTO 4

LEFT SPILLWAY TRAINING WALL

CHEROKEE LAKE DAM

24 DECEMBER 1980

PHOTO 5

CREST OF DAM

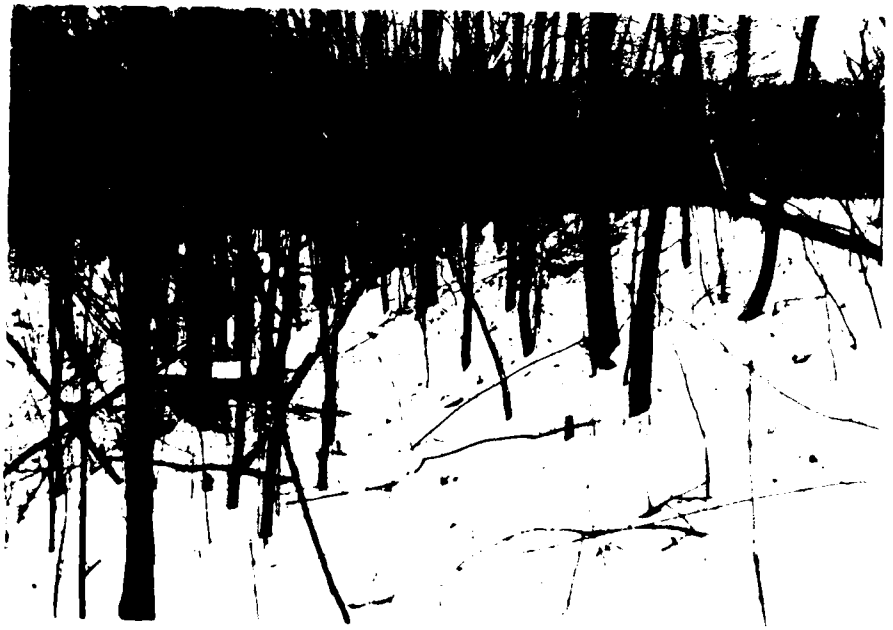


PHOTO 6

DOWNSTREAM FACE OF DAM

CHEROKEE LAKE DAM

24 DECEMBER 1980

PHOTO 7

EMERGENCY SPILLWAY (LOW AREA ADJACENT TO RIGHT END OF DAM)

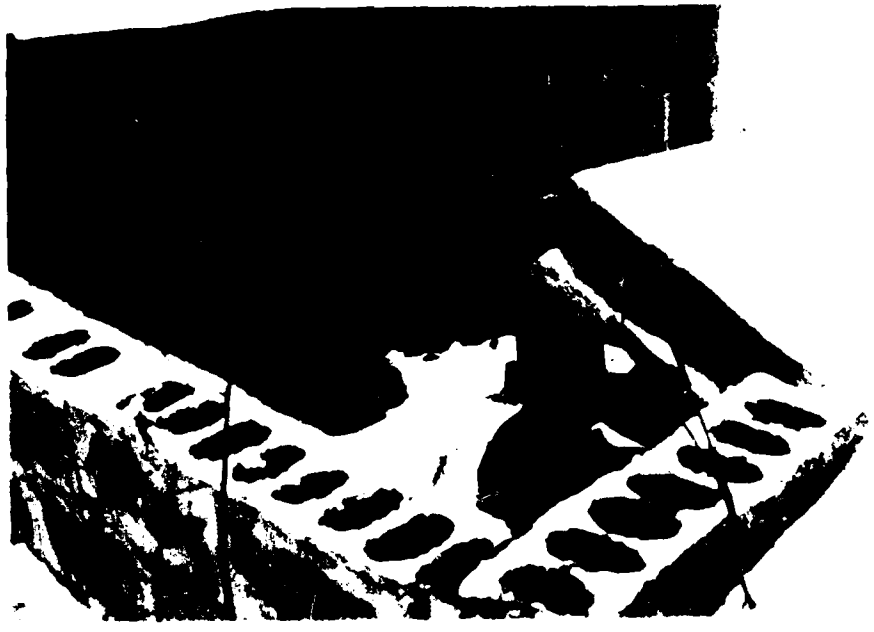


PHOTO 8

VALVES FOR OUTLET WORKS

CHEROKEE LAKE DAM
24 DECEMBER 1980

PHOTO 9

DOWNSTREAM END OF SPILLWAY APRON

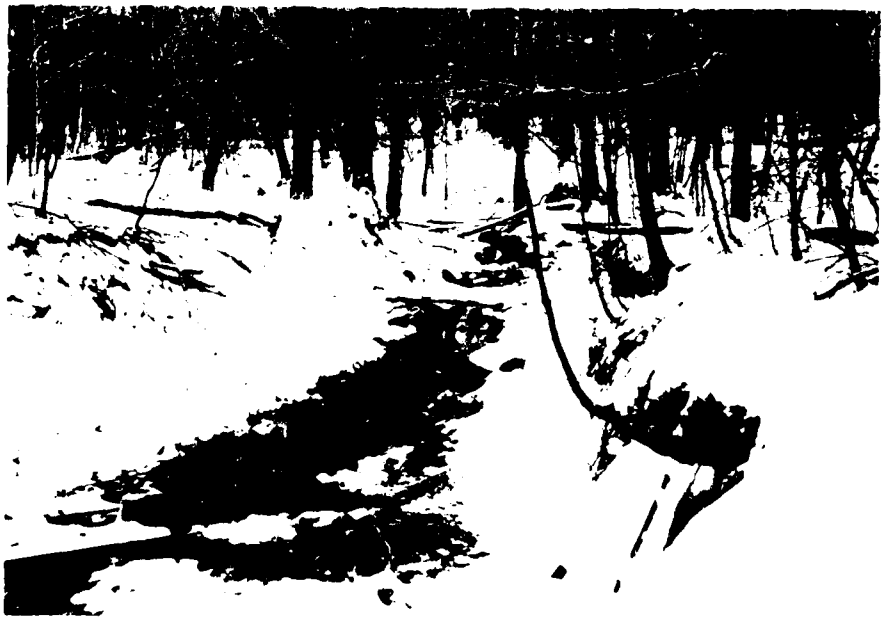


PHOTO 10

DOWNSTREAM CHANNEL

CHEROKEE LAKE DAM
24 DECEMBER 1980

APPENDIX 3

Engineering Data

CHECK LIST

HYDROLOGIC AND HYDRAULIC DATA

ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: Wooded and residential

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 935.0 (35 acre ft.)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): N.A.

ELEVATION MAXIMUM DESIGN POOL: 937.8

ELEVATION TOP DAM: 937.5

PRINCIPAL SPILLWAY CREST: Uncontrolled Concrete Weirs

a. Elevation 935.0 (Primary) - 935.6 (Secondary)

b. Type Broad Crested Weirs

c. Width 1.5 Feet

d. Length 10.3 Feet (Primary) - 13.7 Feet (Secondary)

e. Location Spillover Center of Dam

f. Number and Type of Gates N.A.

AUXILIARY SPILLWAY CREST: Uncontrolled Grassed Channel

a. Elevation 936.0

b. Type Irregular Grassed Channel

c. Width --

d. Length 20.0 Feet

e. Location Spillover Adjacent to right end of dam

f. Number and Type of Gates N.A.

OUTLET WORKS:

a. Type Twin Gated 10-inch pipes

b. Location Near Center of Dam

c. Entrance Invert 923.4

d. Exit Invert 923.4

e. Emergency Draindown Facilities: Gates Presently Not Operational

HYDOMETEOROLOGICAL GAGES: None

a. Type N.A.

b. Location N.A.

c. Records N.A.

MAXIMUM NON-DAMAGING DISCHARGE:

(Lake Stage Equal to Top of Dam) 412 c.f.s.

APPENDIX 4

Hydraulic/Hydrologic Computations

STORCH ENGINEERS

Project CHEROKEE LAKE DAM

Sheet 1 of 14

Made By JLP Date 1-30-81

Chkd By JG Date 3/2/81

Hydrology

Hydrologic Analysis:

Runoff hydrograph will be developed by HEC-1-DAM computer program using SCS triangular hydrograph with the curvilinear transformation.

Drainage Area = 0.52 SQ. mi.

Infiltration Data

Initial Infiltration	1.5 inches
Constant Infiltration	0.15 in./hr.

Time of Concentration (t_c) (Method #1)

By SCS TR-55

OVERLAND FLOW:

L = 2100'
Δ ELEV = 40'
S = 1.90%
V = 0.30 f.p.s.
Time = 1.94 Hr.

By SCS TR-55 (cont.)

Channel Flow:
L = 3000'
Δ Elev. = 40'
S = 1.33%
V = 2.25 f.p.s.
Time = 0.37 Hr.

t_c = 2.31 Hr.

Time of Concentration (t_c) (Method #2)

by Kerby Pg. 14-36 "Handbook of Applied Hydrology" Chow

$$T_c = \frac{2/3\ L n}{\sqrt{S}}$$

T_c = Time of Concent.
L = Length of Flow
S = Slope
n = Roughness Coeff.

Overland Flow:

L = 2100'
S = 1.90%
n = 0.40
Time = 0.28 Hr.

Channel Flow:
L = 3,000'
S = 1.33%
n = 0.10
0.19 Hr

STORCH ENGINEERS

Project Cherokee Lake Dam

Sheet 3 of 14

Made By JLP Date 1-30-81

Chkd By JG Date 3/2/81

Time of Concentration (t_c) (Method # 3)

N.J. Highway Authority & D.E.P. Nomographs

Overland Flow:

L = 2100'
S = 1.90%
Avg. Grass
Time = 0.72 Hr.

Channel Flow:

L = 3,000'
Δ Elev. = 160'
Time = 0.20 Hr.

t_c = 0.92 Hr.

Time of Concentration (t_c) (Method # 4)

Texas Highway Dept. "Design of Small Dams" U.S. Dept. of Interior, pg. 70. & Navdocks TP-PW-5

OverLand Flow:

L = 2100'
S = 1.90%
V = 1.0 f.p.s.
Time = 0.58 Hr.

Channel Flow:

L = 3000'
S = 1.33%
V = 2.0 f.p.s.
Time = 0.42 Hr.

t_c = 1.00 Hr.

Summary of T_c and Lag Time

Method #1	t_c = 2.31 Hr.
Method #2	t_c = 0.47 Hr.
Method #3	t_c = 0.92 Hr.
Method #4	t_c = 1.00 Hr.

USE T_c = 1.2 Hr.

Lag Time = $0.6\ T_c$ = $0.6\ (1.2)$ = 0.71 Hr.

SQUARE 4 X 4 TO THE INCH

Precipitation

24 Hour, 100-Year Rainstorm Distribution for Cherokee Lake Dam

Time (Hr.)	Rain (inches)
1	0.075
2	0.075
3	0.075
4	0.075
5	0.075
6	0.075
7	0.075
8	0.075
9	0.075
10	0.075
11	0.075
12	0.075
13	0.15
14	0.15
15	0.15
16	0.33
17	0.65
18	3.00
19	0.65
20	0.33
21	0.33
22	0.15
23	0.15
24	0.15
	7.09 inches Total

STORCH ENGINEERS

Project CHEROKEE LAKE DAM

Sheet 6 of 14

Made By JLP Date 1-30-81

Chkd By JG Date 3/2/81

ELEVATION - AREA TABLE

ELEV. (MSL)	AREA (AC.)
930.1	0
935.0	6.0
940.0	23.4
960.0	119.0

HEC-1-DAM COMPUTER Program will develop storage capacity from surface areas & elevations.

Information taken from U.S.G.S. Quadrangle, Mendham, N.J.

SQUARE 4 X 4 TO THE INCH

DIVERSION STREAM

Portion of inflow is diverted around lake by diversion stream during low flow conditions. (See Plate 4). However, for routing purposes, all inflow will be assumed to enter the lake during storm events.

HYDRAULICS

Stage Discharge Calculation

Spillway Capacity:

The spillways at Cherokee Lake Dam consist of the following: a principal spillway with a 2-stage concrete weir and an emergency spillway consisting of a grassed low area adjacent to the right end of the dam. The primary and secondary weirs of the spillway are broad crested weirs with effective lengths of 10.3' and 13.7' respectively. The emergency spillway has an effective width of 20'.

Discharge Q, can be calculated by:

$$Q = C L h^{3/2}$$

where:
- Q = discharge over spillway
- C = discharge coefficient
- L = effective length of spillway
- h = total head on spillway

Values for the discharge coefficient, "C" were taken from the "Handbook of Hydraulics" by [illegible] Brater

STORCH ENGINEERS

Project CHEROKEE LAKE DAM Made By JLP Date 1-30-81 Sheet 9 of 14

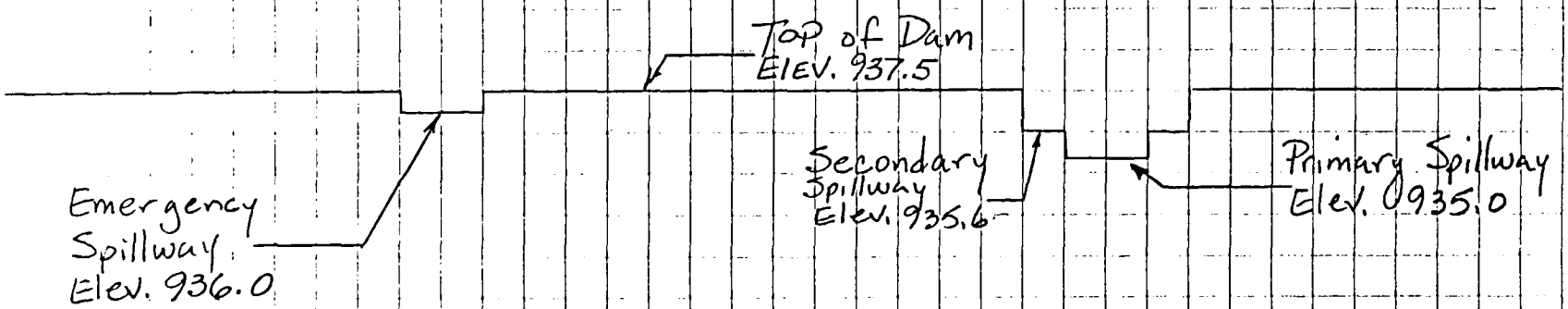
Chkd By JG Date 3/2/81

SQUARE 4 X 4 TO THE INCH

SPILLWAY STAGE DISCHARGE TABULATION

	PRIMARY				SECONDARY				EMERGENCY				TOTAL
ELEV.	C	L	h	Q	C	L	h	Q	C	L	h	Q	Q
935.0	2.64	10.3	0.0	0.0	2.64	3.7	0.0	0	3.00	20.0	0	0	0
935.6	2.64	10.3	0.6	12.6	2.64	3.7	0.0	0	3.00	20.0	0	0	13
935.96	2.75	10.3	0.96	26.6	2.64	3.7	0.36	7.8	3.00	20.0	0	0	34
936.0	2.75	10.3	1.00	28.3	2.64	3.7	0.40	9.1	3.00	20.0	0.04	0.5	38
937.0	3.03	10.3	2.00	88.3	2.92	3.7	1.40	66.3	3.00	20.0	1.04	63.6	218
938.0	3.32	10.3	3.00	117.7	3.28	3.7	2.40	167.1	3.00	20.0	2.04	174.8	460
938.32	3.32	10.3	3.32	206.9	3.32	3.7	2.72	204.0	3.00	20.0	2.36	217.5	628
939.0	3.32	10.3	4.00	273.6	3.32	3.7	3.40	285.1	3.00	20.0	3.04	318.0	877
940.0	3.32	10.3	5.00	382.3	3.32	3.7	4.40	419.8	3.00	20.0	4.04	487.2	1289
941.0	3.32	10.3	6.00	502.6	3.32	3.7	5.40	570.8	3.00	20.0	5.04	678.9	1752

Note: Elev. of top of dam varies 937.5 to 938.4. Use 937.5.



FRONT ELEVATION

STORCH ENGINEERS

Project CHEROKEE LAKE DAM

Sheet 10 of 14

Made By JLP Date 1-30-81

Chkd By JG Date 3/2/81

SQUARE 4 X 4 TO THE INCH

EL.	Q
935.0	0
935.6	13
936.0	34
936.0	38
937.0	218
938.0	460
939.0	877
940.0	1289
941.0	1752

SPILLWAY STAGE DISCHARGE CURVE

TOP OF DAM
ELEV. 937.5

ELEVATION (ft.)

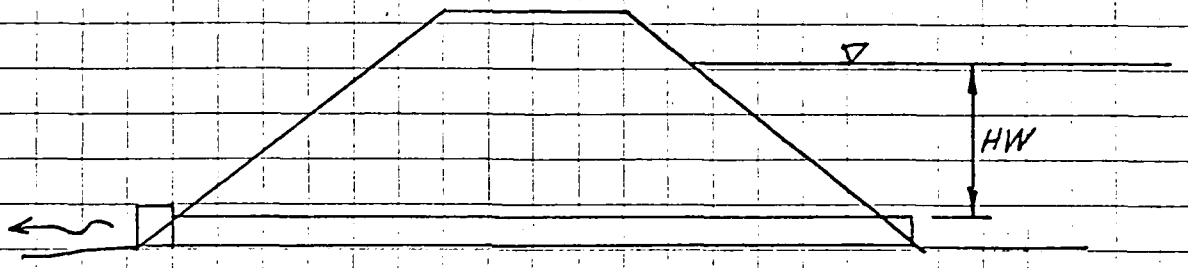
941.0
940.0
939.0
938.0
937.0
936.0
935.0

Q (cfs)

0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600 1700

Drawdown Capacity

Outlet works consist of twin 10-inch pipes. Discharge is computed using "Hydraulic Charts For the Selection of Highway Culverts," Bureau of Public Roads, 1963, assuming inlet control.



Maximum discharge, HW = 10.8
Q = 10 c.f.s.
Average discharge, HW = 5.4
Q = 5.5 c.f.s. per pipe

Drawdown

$$\text{Drawdown Time} = \frac{\text{Storage at Spillway}}{\text{Aver. Discharge} - \text{Aver. Inflow}}$$

$$= \frac{35 \text{ acre-ft} \times 43560 \text{ sq. ft/acre}}{(11 \text{ cfs} - 0.5 \text{ cfs}) \times 3600 \text{ sec/hr.}}$$

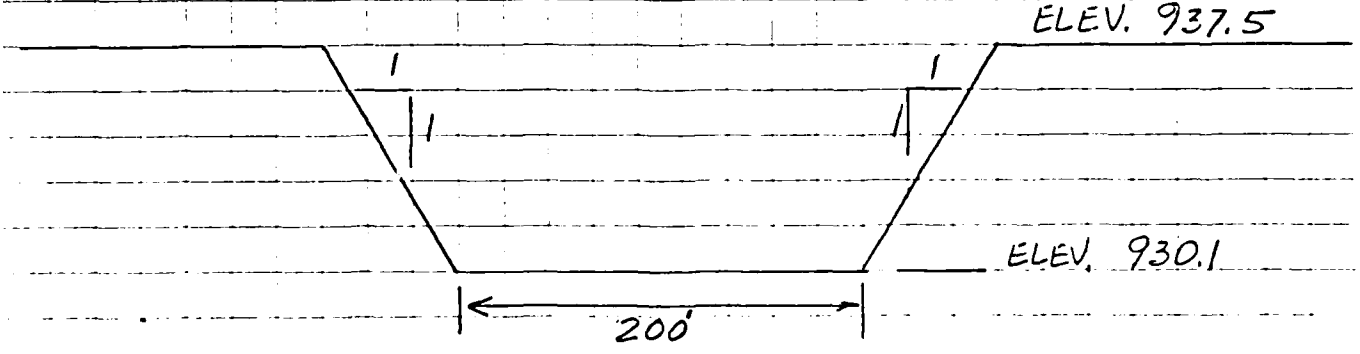
$$= 40.3 \text{ hr.}$$

$$= 1.7 \text{ days}$$

BREACH ANALYSIS

A BREACH HYDROGRAPH WILL BE COMPUTED BY THE HEC-1-DAM PROGRAM AND ROUTED THROUGH TWO DOWNSTREAM REACHES BY THE MODIFIED PULS METHOD. THE ASSUMED BREACH CONDITIONS ARE AS FOLLOWS:

1. THE BREACH BEGINS WHEN THE WATER SURFACE ELEVATION REACHES 937.5.
2. TIME TO DEVELOP BREACH = 1.0 HR.
3. SECTION



FULLY DEVELOPED BREACH

STORCH ENGINEERS

Project CHEROKEE LAKE DAM

Sheet 13 of 14

Made By JLP Date 2-2-81

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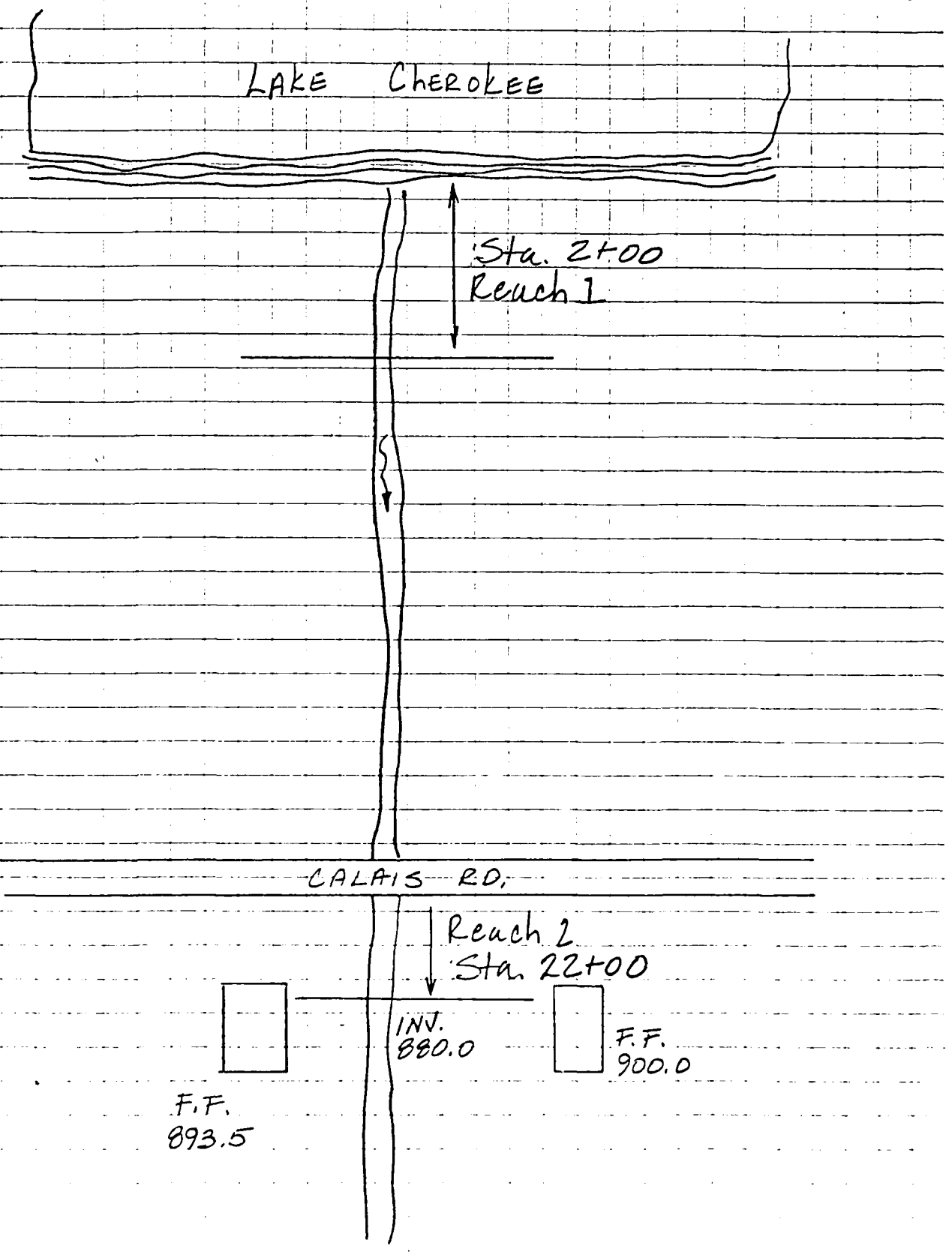
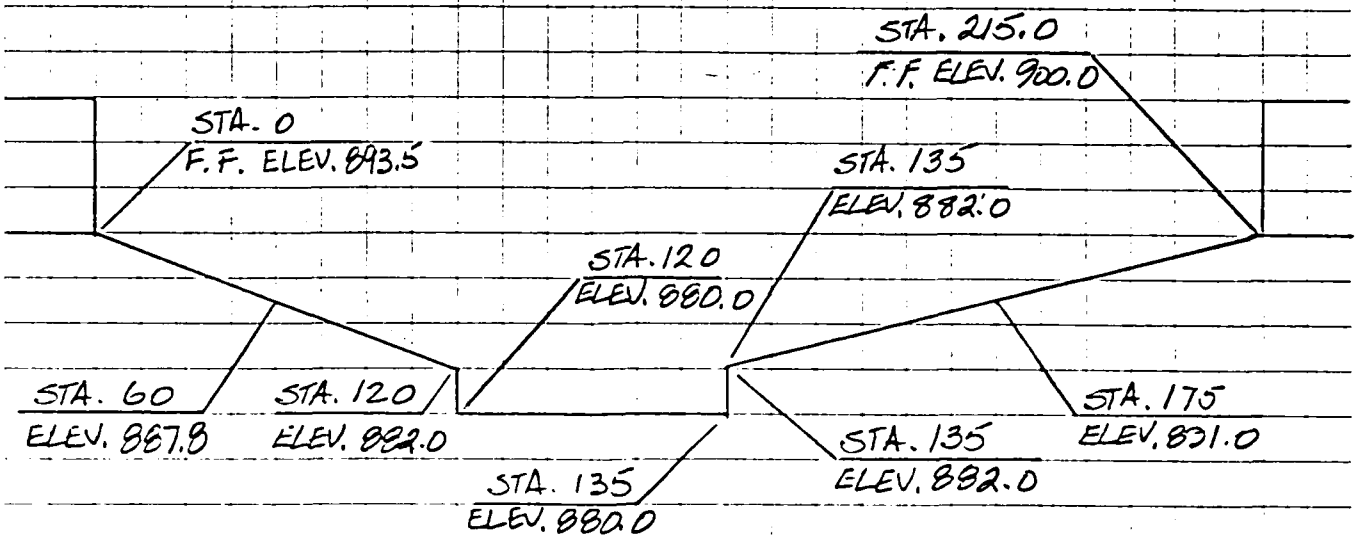


STORCH ENGINEERS

Sheet 14 of 14

Project CHEROKEE LAKE DAM Made By JLP Date 2-2-81

Chkd By JG Date 3/2/81



CROSS SECTION END OF REACH 2

S = 0.018

BREACH RESULTS:

1. Peak Outflow = 1844 cfs
2. Maximum Channel Stage, Reach 2 = 885.8
3. Dwellings not inundated.

HEC - 1 - DAM PRINTOUT

Overtopping Analysis

```
1A1       NATIONAL DAM SAFETY PROGRAM
A2        CHEROKEE LAKE DAM, NEW JERSEY
A3        100 YEAR STORM ROUTING
B     300         0        15                                    0         0         4
B1      5
J       1         1         1
J1      1
K       0      LAKE                          0         0         1
K1        INFLOW HYDROGRAPH TO CHEROKEE LAKE DAM
M       0         2      0.52                0.52         0                             1
O      96
O1  0.019     0.019     0.019     0.019     0.019     0.019     0.019     0.019     0.019     0.019
O1  0.019     0.019     0.019     0.019     0.019     0.019     0.019     0.019     0.019     0.019
O1  0.019     0.019     0.019     0.019     0.019     0.019     0.019     0.019     0.019     0.019
O1  0.019     0.019     0.019     0.019     0.019     0.019     0.019     0.019     0.019     0.019
O1  0.019     0.019     0.019     0.019     0.019     0.019     0.019     0.019     0.038     0.038
O1  0.038     0.038     0.038     0.038     0.038     0.038     0.038     0.038     0.038     0.038
O1  0.083     0.083     0.083     0.083     0.163     0.163     0.163     0.163     0.750     0.750
O1  0.750     0.750     0.163     0.163     0.163     0.163     0.083     0.083     0.083     0.083
O1  0.083     0.083     0.083     0.083     0.038     0.038     0.038     0.038     0.038     0.038
O1  0.038     0.038     0.038     0.038     0.038     0.038
T                                                               1.5      0.15
W2              0.71
X    -1.0     -0.05      2.0
K       1       DAM
K1        ROUTE DISCHARGE THROUGH DAM
Y                                         1         1
Y1      1                                                    -935.0        -1
Y4  935.0     935.4     935.8     936.0     937.0     938.0     939.0     940.0     941.0
Y5      0      12.6      40.3      44.7     260.2     563.7    1051.9    1544.8    2097.6
$A      0       2.5      5.97     23.42    119.38
$E  934.1     934.5     935.0     940.0     960.0
$$  935.0
$D  937.5      2.63       1.5       656
K       1         1                                                    1
K1        CHANNEL ROUTING REACH 1
Y                                         1         1
Y1      1
Y6    0.1     0.035       0.1     916.4       938       200     0.018
Y7      0       938       100       928       200     918.4       200     916.4       215     916.4
Y7    215     916.4       465       928       715       938
K       1         2                                                    1
K1        CHANNEL ROUTING REACH 2
Y                                         1         1
Y1      1
Y6    0.1     0.035       0.1       880       900      2200     0.018
Y7      0       882       175       891       215       900
K      99
```

NATIONAL DAM SAFETY PROGRAM
CHEROKEE LAKE DAM, NEW JERSEY
100 YEAR STORM ROUTING

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	15	0	0	0	0	0	4	0

	JOPER	NWT	LROPT	TRACE
	5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 1 LRTIO= 1

RTIOS= 1.00

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH TO CHEROKEE LAKE DAM

	ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
	LAKE	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
0	2	.52	0.00	.52	0.00	0.000	0	1	0

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.50	.15	0.00	0.00

UNIT HYDROGRAPH DATA

TC= 0.00 LAG= .71

RECESSION DATA

STRTQ= -1.00 QRCSN= -.05 RTIOR= 2.00

0

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	7.12	4.33	2.79	6259.
										(181.)(	110.)(	71.)(	177.24)

HYDROGRAPH ROUTING

ROUTE DISCHARGE THROUGH DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
DAM	1	0	0	0	0	0	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-935.	-1

STAGE	936.00	936.60	936.90	936.00	937.00	938.00	939.00	940.00	941.00
FLOW	0.00	12.60	40.30	44.70	260.20	563.70	1051.90	1544.80	2097.60
SURFACE AREA=	0.	3.	6.	23.	119.				
CAPACITY=	0.	0.	35.	104.	1408.				
ELEVATION=	926.	927.	935.	940.	960.				

CREL	SPWID	COOW	EXPW	ELEVL	COOL	CAREA	EXPL
935.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
937.5	2.6	1.5	656.

PEAK OUTFLOW IS 723. AT TIME 18.50 HOURS

OPERATION	STATION	AREA	PLAN	RATIO 1	RATIOS APPLIED TO FLOWS
				1.00	
HYDROGRAPH AT	LAKE	.52	1	739.	
		(1.35)		(20.92)(	
ROUTED TO	DAM	.52	1	723.	
		(1.35)		(20.48)(	
ROUTED TO	1	.52	1	720.	
		(1.35)		(20.39)(	
ROUTED TO	2	.52	1	682.	
		(1.35)		(19.31)(	

1

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	935.00	935.00	937.50
STORAGE	35.	35.	59.
OUTFLOW	0.	0.	412.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	937.76	.26	62.	723.	1.00	18.50	0.00

PLAN 1 STATION 1

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
1.00	720.	920.0	18.50

PLAN 1 STATION 2

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
1.00	682.	883.6	18.50

HEC - 1 - DAM PRINTOUT

Breach Analysis

```
1A1       NATIONAL DAM SAFETY PROGRAM
A2        CHEROKEE LAKE DAM, NEWJERSEY
A3        100 YEAR STORM ROUTING
B       300       0       15                                          0       0       4
B1        5
J         1       1       1
J1        1
K         0    LAKE                                  0       0       1
K1          INFLOW HYDROGRAPH TO CHEROKEE LAKE DAM
M         0       2    0.52                  0.52       0                               1
O        96
O1  0.019    0.019   0.019   0.019   0.019   0.019   0.019   0.019   0.019   0.019
O1  0.019    0.019   0.019   0.019   0.019   0.019   0.019   0.019   0.019   0.019
O1  0.019    0.019   0.019   0.019   0.019   0.019   0.019   0.019   0.019   0.019
O1  0.019    0.019   0.019   0.019   0.019   0.019   0.019   0.019   0.019   0.019
O1  0.019    0.019   0.019   0.019   0.019   0.019   0.019   0.019   0.038   0.038
O1  0.038    0.038   0.038   0.038   0.038   0.038   0.038   0.038   0.038   0.038
O1  0.083    0.083   0.083   0.083   0.163   0.163   0.163   0.163   0.750   0.750
O1  0.750    0.750   0.163   0.163   0.163   0.163   0.083   0.083   0.083   0.083
O1  0.083    0.083   0.083   0.083   0.038   0.038   0.038   0.038   0.038   0.038
O1  0.038    0.038   0.038   0.038   0.038   0.038
I                                                    1.5     0.15
W2           0.71
X    -1.0    -0.05     2.0
K         1     DAM
K1          ROUTE DISCHARGE THROUGH DAM
Y                                       1       1
Y1        1                                             -935.0      -1
Y4  935.0    935.6   935.9   936.0   937.0   938.0   939.0   940.0   941.0
Y5        0     12.6    40.3    44.7   260.2   563.7  1051.9  1544.8  2097.6
$A        0      2.5    5.97   23.42  119.38
$E  926.1    926.5   935.0   940.0   960.0
$$  935.0
$D  937.5     2.63     1.5     656
$B      200       1   926.1     1.0     935   937.5
K         1       1                                             1
K1          CHANNEL ROUTING REACH 1
Y                                       1       1
Y1        1
Y6      0.1   0.035     0.1   916.4     938     200   0.018
Y7        0     938     100     928     200   918.4     200   916.4     215   916.4
Y7      215   918.4     465     928     715     938
K         1       2                                             1
K1          CHANNEL ROUTING REACH 2
Y                                       1       1
Y1        1
Y6      0.1   0.035     0.1     880     900    2200   0.018
Y7        0   893.5      60   887.8     120     882     120     880     135     880
Y7      135     882     175     891     215     900
K        99
A
```

HYDROGRAPH ROUTING

ROUTE DISCHARGE THROUGH DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
DAM	1	0	0	0	0	0	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	=935.	-1

STAGE	935.00	935.60	935.90	936.00	937.00	938.00	939.00	940.00	941.00
FLOW	0.00	12.60	40.30	44.70	260.20	563.70	1051.90	1544.80	2097.60
SURFACE AREA=	0.	3.	6.	23.	119.				
CAPACITY=	0.	0.	35.	104.	1408.				
ELEVATION=	926.	927.	935.	940.	960.				

CREL	SPWID	COOW	EXPW	ELEVL	COOL	CAREA	EXPL
935.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
937.5	2.6	1.5	656.

DAM BREACH DATA

BRWID	Z	ELBM	TFAIL	WSEL	FAILEL
200.	1.00	926.10	1.00	935.00	937.50

BEGIN DAM FAILURE AT 18.25 HOURS

PEAK OUTFLOW IS 1850. AT TIME 18.52 HOURS

RATIOS APPLIED TO FLOWS

OPERATION	STATION	AREA	PLAN	RATIO 1
				1.00
HYDROGRAPH AT	LAKE	.52	1	739.
		(1.35)		(20.92)(
ROUTED TO	DAM	.52	1	1844.
		(1.35)		(52.22)(
ROUTED TO	1	.52	1	1764.
		(1.35)		(49.96)(
ROUTED TO	2	.52	1	1695.
		(1.35)		(48.00)(

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	935.00	935.00	937.50
STORAGE	35.	35.	59.
OUTFLOW	0.	0.	412.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	937.66	.16	61.	1850.	.35	18.52	18.25

PLAN 1 STATION 1

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
1.00	1764.	921.7	18.50

PLAN 1 STATION 2

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
1.00	1695.	885.8	18.75

APPENDIX 5

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MAY 81 R J MCDERMOTT, J E GRIBBIN DACW61-79-C-0011
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2 OF 2
AD A101 177

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DATE FILMED
7-81
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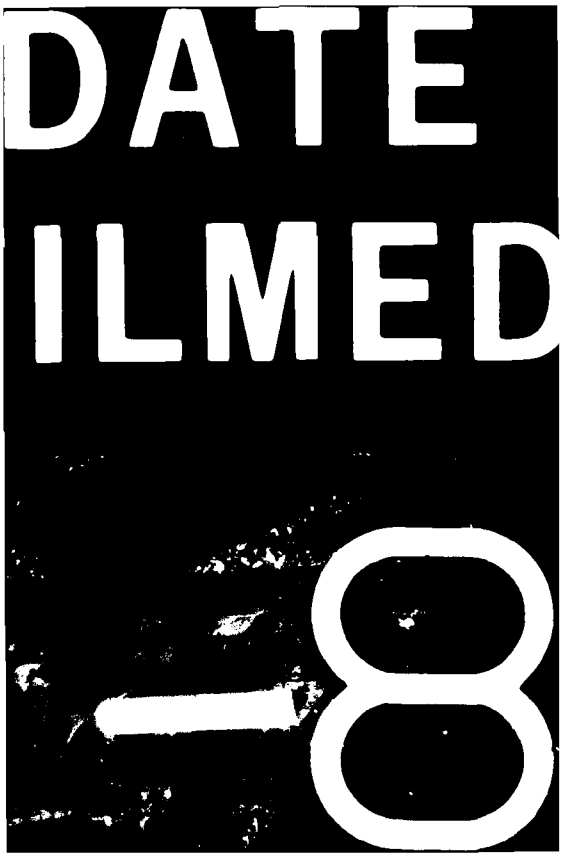
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